

METAL INDUSTRY

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Australian Metals

INCLUDED in a recently published survey of manufacturing activity in Australia is a section dealing with the production and processing of non-ferrous metals. The information given is based on interviews with all major fabricators producing rolled, extruded and drawn products; with manufacturers employing more than 50 per cent of the total employment in the die-casting industry and about 20 per cent of the total employment in the non-ferrous sand casting industry; and with suppliers of both primary and secondary refinery shapes.

Australia is now the world's largest producer of lead, and among the world's largest producers of zinc. A major proportion of the production of lead is exported, while about two-thirds of refinery production of zinc is retained for domestic use. Copper production has increased substantially in recent years and this metal, too, is exported. On the other hand, domestic production of aluminium only meets about half the Australian demand. Secondary non-ferrous metal ingots are produced by fifteen firms. Most of the rolled, drawn and extruded products are processed in Australia from metals produced by the major refineries. The exception is aluminium, of which half the fabricators' requirements is imported. Die-castings are produced in about 150 establishments employing some 3,500 operatives, the industry using annually about 5,500 tons of zinc and 5,700 tons of aluminium. Some brass, bronze and magnesium alloy die-castings are also made. Non-ferrous sand castings are produced in more than 400 establishments (not including captive foundries), the majority of foundries being small firms employing less than 10 persons.

After a period of difficulty in early post-war years, production of non-ferrous metals in Australia expanded greatly as comprehensive programmes for mechanization and re-equipment were completed and new capacity installed. Domestic consumption also increased. In recent years, however, the consumption of copper has not reached the peak levels of 1952-53, and there has been a tendency for secondary to replace primary lead metal in consumption. In contrast, there has been a big increase in zinc consumption, reflecting the increased requirements of the steel industry for galvanizing. In the six months ending April this year, production of non-ferrous metals by the major refineries remained fairly steady, as did also the production of secondary ingots. Though the market for copper and copper alloy products in the same period remained fairly quiet, the production of copper tube increased by 5 per cent and sheet by slightly less to meet increased demands from the building industry. Production and sales of aluminium were up about 12½ per cent compared with those of the previous six months, and this upward trend in demand is expected to continue. Die-casting production was also up a further 5 per cent above the improved level recorded in October, 1957, and sales have increased in value by 7 per cent. On the other hand, except in the case of foundries specializing in the manufacture of high-grade precision phosphor-bronze castings, whose production was maintained at steady levels, production by jobbing foundries of non-ferrous sand castings for general machinery and plant manufacture declined about 5 per cent.

The non-ferrous metals industries make a substantial contribution to Australia's balance of trade. Thus, in 1956-57 copper and copper-base alloys to the value of £A6,935,265, lead to the value of £A32,288,056, and zinc to the value of £A5,073,912, were exported. In the same year, exports of copper products other than refinery products totalled nearly £A1 million. Exports of aluminium products are negligible, but in 1956-57 zinc products to the value of £A380,000 were exported, mainly to India, Singapore and New Zealand.

Out of the MELTING POT

Problems for Synthesis

WHERE the chemical aspects are concerned, the synthesis of a substance provides the complete answer. Where the economic aspects are concerned, a choice may have to be made between one method of synthesis and another, or the adoption of a synthetic approach may have to be delayed pending the development of a still cheaper method. Where the physical aspects are concerned—even after the method has successfully passed the chemical and the economic muster—the synthesis of a substance, if that substance happens to be a solid, is usually only the beginning. Our understanding of the solid state being incomplete, progress beyond such a beginning has to be empirical and uncertain: a bit of an anti-climax following upon the achievement of successful synthesis. One such anti-climax, for example, has followed upon the announcement, a little over three years ago, of one of the most spectacular break-throughs on the synthesis front—the production of synthetic diamonds. There was no doubt that the diamonds really were diamonds, and quite soon it proved that they were able to compete costwise with natural diamonds. On the physical side, much ground remains to be covered, however, and a great deal of knowledge has to be accumulated. A contribution to the latter has recently been made by a study of the performance of synthetic, as compared with natural diamonds, in resin- and vitreous-bonded grinding wheels used to grind tungsten carbide. The synthetic diamonds, having a rougher surface, are more firmly held in the wheel and, being more friable than the natural stones, tend to fracture more readily, thereby exposing new sharp cutting edges, resulting in a freer-cutting wheel, lower power requirements, and increased stock removal. All this adds up to an improvement of up to 100 per cent in the performance of grinding wheels containing synthetic diamonds in place of natural diamonds. On the other hand, the greater friability of the synthetic diamonds makes them inferior in metal-bonded wheels and in cutting-off applications where pressure on the wheel is high. No doubt developments in the method and conditions of synthesis will, in due course, catch up with these and other physical requirements (up to and including those of "sparklers") as they have already done with the chemical, and are doing with the economic requirements.

Not by Addition

CAN a problem be solved by providing a large amount of information relating to it? Clearly, the probability will be greater the larger the amount of relevant information collected. It is on this obvious conclusion that requests for comprehensive information, and the multifarious activities aimed at collecting and supplying information on all sorts of problems are based. In view of the obvious nature of the basic premise, and also the successes achieved by the information-gathering and disseminating activities, it is, perhaps, not surprising that the fact that a special problem cannot be solved in this way has been largely overlooked. This special problem is that presented by the existence of the large and ever-growing amount of information on all manner of subjects. An excellent example of a situation of this kind is to be found in the field of engineering materials, which extends from cermets to plastics. The number of materials and the volume of information about them is growing at a

remarkable rate. Quite a lot of evidence is available pointing to the fact that solutions of this problem, presented by the volume of information about engineering materials, are being sought—with the best possible intentions incidentally—in terms of collecting and providing more information. Can it be that so far the only possible way of solving the problem—by reducing the amount of information by some means or other—has not been considered because it has not been recognized, or simply because it would have been contrary to the procedure that has worked reasonably well in all other cases. It will certainly have to be considered when this piling of information on information will have become plainly ridiculous.

Broader

HOWEVER interesting the observations of the unusual mechanical properties of metal whiskers may have been initially, it is with some relief that one notes a broadening of the front on which further investigations are being pushed forward. A much wider range of materials, both metallic and non-metallic, is now being studied, and a variety of methods of obtaining specimens is being used. Indeed, the range and variety are now such that the term "whiskers" is no longer always applicable throughout, and here and there has given way to the more general term "microcrystals." The above remarks are admirably borne out by a recent contribution on the subject. Entitled "Mechanical Behaviour of Microcrystals," it is concerned with crystals of beta-manganese, Mn_3Si_2 , $\alpha-Si_3N_4$, $\alpha-Al_2O_3$, Cr_3O_4 , Cr_2N , chromium, and Fe_3C . Methods of obtaining specimens for the investigations included the growing of whiskers and other small crystals by chemical reaction in liquid and vapour phases, and precipitation within a two-phase alloy, followed by extraction of the precipitated crystals by chemical or electrochemical treatments. For example, the iron carbide crystals were recovered from suitably heat-treated 1.3 per cent carbon steel by electrolysis in dilute hydrochloric acid, while the chromium metal crystals were obtained by dissolving away the copper from a copper-rich eutectic alloy of copper and chromium with 50 per cent nitric acid or a mixture of sodium hydroxide and hydrogen peroxide. All these specimens, when subjected to bend tests, exhibited very large elastic strains without failure, and also gave ultimate strengths approaching the theoretical values. These results suggest that exceptional strength, hitherto regarded as a unique property of whiskers, may actually be quite a common characteristic of other small crystals. Such microcrystals can be divided into "hard" crystals (Fe_3C , $\alpha-Al_2O_3$, etc.), in which it is thought the motion of dislocations is sufficiently difficult that brittle fracture occurs before plastic deformation, and "soft" crystals (copper, very pure iron, silver, and chromium), which fail by plastic deformation. Apart from the intrinsic interest of these observations on the mechanical behaviour of microcrystals, the fact that some of them had been formed by precipitation in alloys permits some consideration of the behaviour of such particles when dispersed in alloys, and of the strengthening of alloys by dispersed particles in the light of the measurements of the strength of such particles when isolated from the alloy.

Skinner

PRODUCTION OF FOUNDRY CHEMICALS AT DRAYTON MANOR

Foundry Services Limited

Among the works to be visited by delegates to the Golden Jubilee Autumn Meeting of the Institute of Metals is the Drayton Manor Works of Foundry Services Ltd. Completed only two years ago, it produces over 200 products from the company's range of foundry chemicals.

FOUNDED in 1932 in Birmingham for the manufacture of foundry fluxes, Foundry Services Limited — Fosco — occupied early premises that were small and primitive, vastly different from the modern plant of to-day. From that early beginning, the company moved to another site in Long Acre, Nechells, Birmingham—a site which is currently occupied by the firm's head office, research and service laboratories.

During World War II, in addition to the main works in Birmingham, the company operated, on behalf of the Government, a plant for the production of anhydrous magnesium chloride to aid the manufacture of magnesium castings for the aircraft industry. This factory was located at Drayton Manor, near Tamworth, and production there ceased at the end of the war. However, with an eye to the future, the Fosco directors purchased the works area and surrounding land so that now some forty acres are available for development.

The postwar years were years of regular and rapid expansion, and soon it became apparent that increased production requirements could not be met in the congested Nechells' buildings, nor in the limited number of buildings originally erected at Drayton Manor. It was decided therefore, to build a new factory at Drayton Manor, and this was completed towards the end of 1956—a fine modern structure in a rural setting, occupying some 94,000 ft².

Up to 1956 only limited manufacture had been carried out on the new premises, a large part of the output still being produced in Birmingham.

The operations carried out in this factory consist of mixing chemicals of strictly controlled specification in scientifically determined proportions and packing them into convenient "ready to use" forms for the foundry.

The range of products made at the factory is many and varied. In all, some 350 different chemicals are converted into over 200 different products, which can be subdivided into approximately 1,000 productive units. The major breakdown of production is: exothermic materials; powder fluxes and dressings; packeting; tableting; briquetting, and the mixing of pastes and liquids.

Within the last six months an extension of some 25,000 ft² has been made to the factory to further the large-scale

production of exothermic sleeves and shapes.

Many of the chemicals used in the manufacture of Fosco products are purchased in a condition in which they can ultimately be used. The remainder, however, are not readily available in the exact form as specified by the technical division. For this reason, some 2,000 tons/year of raw materials are obtained in a state which necessitates subsequent processing. This processing can be either a simple, controlled drying operation or a more complex series of operations in which materials may be dried, crushed, finely ground in ball mills, or screened to closely stipulated tolerances.

The keynote in the works is "quality and service." To ensure this, a high ratio of supervisory staff to hourly paid employees is essential. Currently, some 200 of the latter (including 60 women) are employed. The works' staff numbers 50, and a further 15 laboratory personnel are employed purely on quality control. This works control section at Drayton Manor can, of course, call on the wider resources existing at the main laboratories in Birmingham.

Altogether in England the Foundry Services Group employs some 500 people; just under 70 of these are

engaged on research and technical matters, and a section of the technical division is engaged wholly on detailed investigations of customers' queries.

Endeavour is made to despatch orders within four days of their receipt. In point of fact, over 75 per cent of all orders received are despatched within two days. Giving such a service necessitates the carrying of large stocks of raw materials and finished products, coupled to a very flexible production system and a well organized transport department.

Most of the manufacturing is now carried out in the new factory, though use is still made of the original buildings for certain production which, for special reasons, it is desirable to segregate. The most important activity in this category is the production of bulk exothermic materials, with the now familiar names, Feedex, Feedol, Ferrux, Kalmex and Thermexo.

Foundry Services Limited quickly realized the potentials of exothermic materials, and so pioneered and developed this field that the exothermic feeding of castings and ingots is an accepted standard practice to-day. In exothermic products, heat is obtained from the burning of finely divided aluminium, the presence of which presents a possible explosion hazard during production. Mixing is done, therefore, in especially constructed cubicles with blast-proof walls and a lightly constructed roof to act as a

A view of the conveyor line in the exothermic section of the Fosco Drayton Manor works



blast relief in the event of explosion. In addition, a system of electrically and mechanically interlocking doors is operated so that it is impossible for any operators to be in the vicinity of the mixing drum once it is in motion.

Another process separated from the new factory is the fusing of magnesium chloride based fluxes in electric fusion cells. The process is necessary because of the highly anhydrous nature of magnesium chloride. This chemical forms the basis of fluxes for the melting of magnesium and aluminium-magnesium alloys, where it is imperative that moisture content is controlled at a low level.

In the old works, the handling of metallic sodium is also carried out. It is cut, weighed and wrapped in aluminium foil in a variety of sizes, or, alternatively, melted under vacuum before being put into aluminium containers (Foseco Nametal and Navac respectively).

Throughout the factory, a system of palletization is used wherever possible to deal with all handling problems. Suppliers are encouraged to send in their chemicals on pallets. Where this is not possible, raw materials are unloaded direct on to pallets and transported into the warehouse by fork lift trucks.

Chemicals are purchased to tight specifications laid down by the Technical Division. Even so, incoming materials are always carefully checked in the works control laboratory for mesh grading, moisture content, impurity level, etc.

From the raw material warehouse, materials are carefully weighed and taken on stillages via a lift to the charging deck. From here they are gravity-fed down chutes into the various mixers, tableting machines, etc., on the ground floor.

In the section devoted to powdered fluxes and dressings, simple horizontal

trough mixers are used. Several of these are jacketed to permit hot mixing of those products where it is important that the resultant moisture content be kept at a minimum. The mixed powders are discharged into either paper or hessian sacks, or into polythene-lined drums, ready for direct sale as bulk material. Alternatively, mixed material forms merely the first stage of a final tableted or packeted product.

While, as described, Foundry Services' products can be supplied in bulk, many foundrymen prefer to receive them in preweighed quantities of exactly the right amount for their particular melts. Accordingly, many fluxes can be supplied, accurately weighed, in small packets. This packeting operation is carried out both manually and by semi-automatic means, according to the quantities required.

In the case of products which require plunging into molten metal, such as the wide range of Foseco degassers and nucleants, it is desirable that they be supplied in tablet form, and so these chemical mixtures are pressed into tablets varying in size from 1 oz. to 32 oz. units.

Tableting is done on hydraulic presses, which allow for accurate control and permit the production of high quality tablets over a wide variety of chemicals. Tablets are then wrapped in attractive aluminium foil film wrappers and heat-sealed to provide a moisture-proof pack.

In the case of certain other chemical mixtures, a separate binder has to be added, and the block produced is subsequently oven dried to develop sufficient strength. Such briquettes are made on mechanically-operated vertical presses, capable of pressures up to 150 tons. Typical products in this range are Foseco Brix and Cuprex.

The mixing of pastes is a specialized

field. Foundry Services' preparations range from simple mixtures of liquids to complex emulsions. Within this category come the many Foseco Moldcotes, Dycotes, etc.

A preponderance of Foundry Services Ltd. products are made to proven Foseco formulae; other products—such as Foseco deoxidizing tubes—are based on practices which have been accepted in the foundry industry for many years. Foseco deoxidizing tubes, which are produced in large quantities, consist of a copper envelope formed from strip and filled with carefully weighed quantities of graded deoxidization materials. These tubes provide a convenient, "ready-to-use" and economic form of deoxidization.

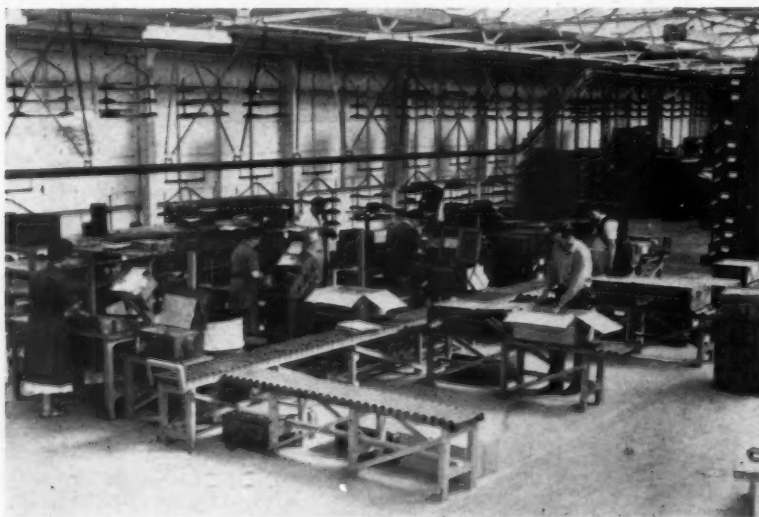
When Foundry Services began the development of exothermics, the finished product—Feedex—was supplied only in bulk form. Customers had to mix it with water and make into suitable shapes, which they then dried in their own core stoves. It became apparent that some of the customers would prefer to buy ready-made exothermic shapes, and soon cylindrical sleeves of varying dimensions were made available to suit individual customers' requirements. The range of these sleeves, supplied in the main to sand foundries, quickly grew to many hundreds, varying in size from 1 in. to 36 in. in internal dimension.

Within the last few years, the advantages gained by virtue of guaranteed quality and increased yields have become appreciated also by the steel industry. Thus, Foundry Services Limited has progressed from the making of simple cylindrical sleeves to a wide variety of infinitely more complex shapes often produced in duplex, i.e. part in exothermic material, part in refractory backing.

The Exothermics Division, located at Drayton and consisting of methods engineers and draughtsmen, etc., works in close liaison with the works unit on the production of complex exothermic feeding heads for steel ingots and non-ferrous billets.

Jolt machines, coresshooters and coreblowers are used for producing the various shapes. The various stations are fed with materials, via chutes, from the charging floor above. Sleeves, once produced, are transferred to a pendulum conveyor system, upon which the sleeves are taken to a gas-fired vertical continuous oven. After the appropriate drying time has elapsed (or cycle has been completed), the shapes are discharged on to the conveyor and, having cooled in transit, are removed for quality control inspection, prior to being packed ready for despatch. Whilst the stove sleeve has considerable strength, the distances many of the sleeves have to travel necessitates considerable care being taken with the method of packing. Individual sleeves are wrapped in wax paper to lessen the possibility of moisture pick-up, and are then packed

Packing section for exothermic sleeves



into wooden boxes or large metal box pallets, in which each sleeve is separated from the next by slotted layer pads of corrugated board. The box pallet has only recently been introduced as a means of despatching sleeves and shapes—its use being confined primarily to steel works, where facilities for handling heavy loads via overhead cranes or fork lift trucks are more readily available.

In this new shop, already nearly 1,000 different core boxes are being used to produce shapes in varying grades of exothermic materials.

Accent is very much on quality control at all stages. In addition to controlling the quality of incoming raw materials, trained personnel investigate manufacturing methods for new products and issue detailed production procedures for the works' supervisory staff. A sub-section of the laboratory is fully occupied with investigating new and improved methods for the manufacture of standard products.

Bearing in mind that Foseco products are almost always associated with molten metal, it is important to ensure that packing is resistant to moisture; consequently, widespread use is made of polyethylene film or other packing media sprayed with this material.

Labour relations have always been



The finished product stores, which is given over completely to palletisation

most satisfactory. There are regular meetings of a works council—consisting of representatives of both management and the various sections within the factory—and a good relationship also exists with the trades unions.

The new factory was designed to incorporate modern cloakroom and

toilet facilities, including showers for the male employees. A modern canteen was built, and at the end of each day this is taken over by a very active social club, which organizes regular dances, whist drives, theatre parties, concerts, sports, and other social functions.

Extrusion Press Repairs

AN interesting repair project, involving the regrinding of a series of rams, was recently carried out "on site" at the Redditch factory of Reynolds T.I. Aluminium Ltd., and arose from the reconditioning of a 2,500/500 ton Loewy extrusion press for aluminium sections and tubes.

The main ram of this press was 45 in. diameter by 9 ft. 4 in., stepped down to 19½ in. diameter by 9 ft. 4 in., overall length 18 ft. 8 in., and weighing approximately 30 tons. The 45 in. diameter portion of the ram required removal of 0.024 in. to ensure a round and parallel surface, and the 19½ in. diameter portion required removal of 0.075 in. in order to rectify wear that had taken place over a number of years. It was essential that, after the regrinding, the 45 in. diameter and the 19½ in. diameter should be concentric to one another. For the work, the "Master Hone" process, operated by Nicol and Andrew Ltd., of Hillington, Glasgow, was used.

A similar treatment was carried out on the twin main return rams, which have two working diameters of approximately 6 in. and 18 in., and an overall length of 23 ft. Again, it was essential that the two diameters should be concentric and that the twin rams should have identical diameters.

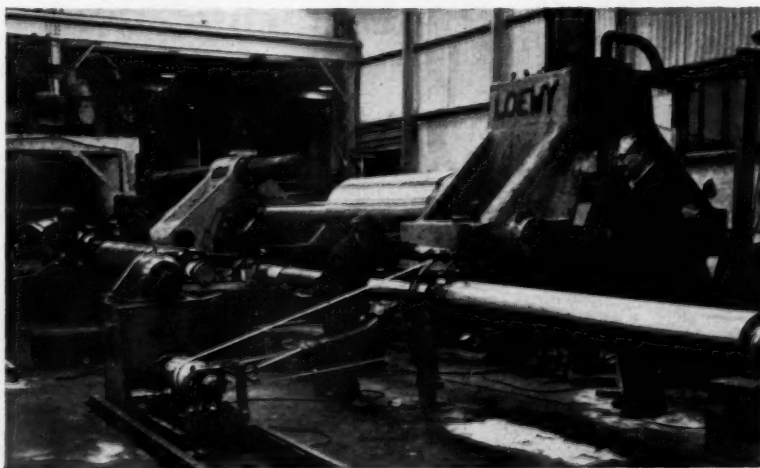
The piercer ram of 20 in. diameter

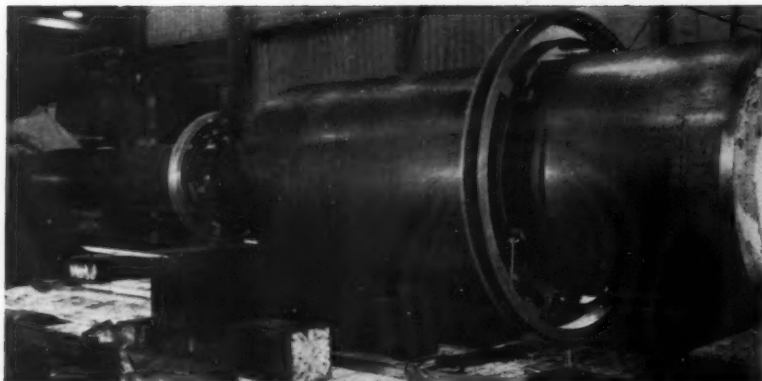
by 12 ft. long was also reconditioned with Master Hone equipment, and with this workpiece it was possible to give a remarkable demonstration of the accuracy of the repair. A bronze neck ring for use on this ram had been obtained with the bore machined 0.001 in. larger than the diameter to which the ram was finished. The neck

ring was placed on the ram and three fitters were able to push it along the ram from end to end, over a distance of 12 ft., without the slightest sign of increased or decreased pressure during the experiment.

The completion of these repairs with Master Hone equipment meant that the press was out of operation for

Reconditioning the rams of an extrusion press by the "Master Hone" process. The arrangement of the hone and its drive can be seen





The main ram of the press with hone assemblies in position

less than half the time required by any other method. In addition, the Reynolds Company were relieved of the cost and organization involved in the transport of plant weighing 30 tons to and from a machine shop equipped with adequate heavy capacity lathes.

The press has been in operation for some weeks since the complete overhaul, and Reynolds T.I. Aluminium have placed orders for a similar operation on a 57½ in. diameter by 12 ft. long ram of a 5,000 ton Loewy extrusion press.

Chemically-Polished Aluminium

ELECTRON microscope investigations by a number of research workers have, in recent years, revealed the existence of sub-structures in chemically polished aluminium surfaces. It has also been established that within these sub-structures each grain contains many thousands of sub-grains, ranging for the most part from 0.2 to 4 microns in size.

Detailed elucidation of the effect of this "sub-texture," its relationship to the previous history of the metal and its applicational significance, has so far been unsuccessful. Investigations have, however, been carried out by D. Altenpohl and W. Hugi, according to an article in *Aluminium* (Germany).

It was found that there was a systematic dependency of the sub-structures on the position of the

observation planes in the metal lattice, on the degree of purity of the aluminium, on the cold deformation, and on the heat-treatment. Although the dimension relationships of the sub-structures found indicate that it is a question of sub-grains, which has already been shown by other work, the confirmation of this assumption awaits the results of further investigational work.

The work was carried out on pure and fine-grade aluminium test pieces of varying degrees of purity. Electron microscopic examination was made of the cast structure, the hot-worked structure, and the sub-texture after cold rolling from 2 mm. to 1 mm., and down to 0.1 mm. respectively, also of the softened condition and of the sub-structure after recrystallization.

Trace Elements

RESearch in the semi-conductor and transistor fields has shown the great importance of knowledge of the presence and concentration of elements present at increasingly lower levels in supposedly pure materials. In a similar manner, atomic energy research has placed greater and greater demands upon the analyst to provide data concerning elements at concentration levels which a few years ago defied determination.

Because of this growing interest in trace analysis, and because emission spectroscopy is one of the few methods available for analytical work at trace levels, a Symposium on Spectrochemical Analysis for Trace Elements was arranged for presentation at the annual meeting of the American

Society for Testing Materials in 1957.

The Papers have now been published, together with discussions, in one volume which contains: "Emission Spectrometric Determination of Oxygen in Metals"; "Spectrographic Determination of Trace Elements in Metals"; "Trace Analysis by Means of Graphite Spark"; "Principles of Quantitative Biological Emission Spectrography"; "Application of Emission Spectrography to Trace Element Analysis in Plant and Soil Samples"; "Spectrochemical Analysis for Trace Elements in Geological Materials."

Copies of this book may be obtained from A.S.T.M. Headquarters, 1916 Race Street, Philadelphia 3, Pa., at \$2.75 each.

Readers' Digest

TESTING MATERIALS

"Handbuch der Werkstoffprüfung"
(*Testing of Materials Handbook*).
Second Edition (in German). Edited by
Prof. Dr. Ing. E. Siebel and Dipl. Ing.
N. Ludwig. Published by Springer-
Verlag, Berlin-Heidelberg. Pp. 890 + xvi.
Price DM.148.50.

AS our requirements become more stringent, more and more defects are found in our products, and testing of materials assumes ever greater importance. Twenty-three contributors, together with two editors, albeit differing in their qualities have compiled this work dealing with the many methods now available in the testing of materials. It is a comprehensive book; one which discusses all types of tensile testing machines and specimen grips; recording apparatus and many types of extensometers; hardness and hardness-testing machines; impact, fatigue and torque—including the testing of crankshafts.

Shearing-stress lines (isochromatics) are discussed, with many good illustrations of plane flow using polarized light through various stressed transparent specimens.

Radiographic and non-destructive testing includes both X-rays and gamma ray apparatus and the use of the Geiger-Mueller counter in welded work and castings; the principles of Magnaflux testing, ultrasonics and other electronic apparatus, such as bridge sorters, etc., are dealt with.

Microscope and metallographic techniques are also included with the electron microscope. The preparation of specimens, e.g. grinding under water and electrolytic polishing; mounting and etching of specimens are discussed, and the book includes some excellent photomicrographs.

The last 90 pages are taken up with instrumental analysis of metals; polarographic, spectrographic, X-ray diffraction, etc.

This excellent handbook of theory and practical testing of materials shows that the technique of testing has developed into an exact science. Every person engaged in the testing of materials should know the theory that underlies his work. Even to those who cannot read German, the illustrations are well worthy of consideration and may prove very helpful. **D. LI.**

Chemical Plant

DESCRIBING the properties of the high-nickel alloys used in the construction of plant handling caustic soda, a booklet has been published by Henry Wiggin and Co. Ltd., under the title "Wiggin Nickel Alloys v. Caustic Alkalies."

Copies are available without charge to chemical engineers and designers, from the company at Thames House, Millbank, London, S.W.1.

Pressure Die-Casting Review

Small Boat Fittings

WHAT constitutes economic production? This is one of those questions that are simple enough to formulate but almost impossible to answer, at least in general terms. In spite of this, general answers are frequently propounded, and various minima are given for economic quantities in die-casting production. One handbook issued under Ministry auspices states that "... It rarely proves economical to pressure die-cast a component if less than five thousand articles are required ..." and most die-casters would consider such a quantity ridiculously small.

Like many seemingly simple questions, the difficulty with this one lies in the fact that there are so many variables affecting any general answer to it, and that in the final analysis a reasonably accurate reply can be founded only on a particular casting in a particular alloy and produced by a particular die-casting foundry. Reduced to such terms, the question may be capable of being answered,

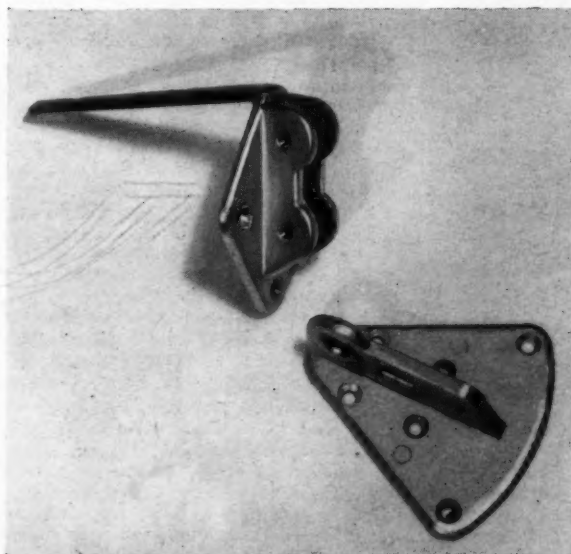
The Yachting World "Solo" racing dinghy, one of the many classes of small boats which are equipped with Holt-Allen fittings



though few would find an answer comparable with that being provided by Allen Bros., of Bates Yard, Church Road, Harold Wood, Essex.

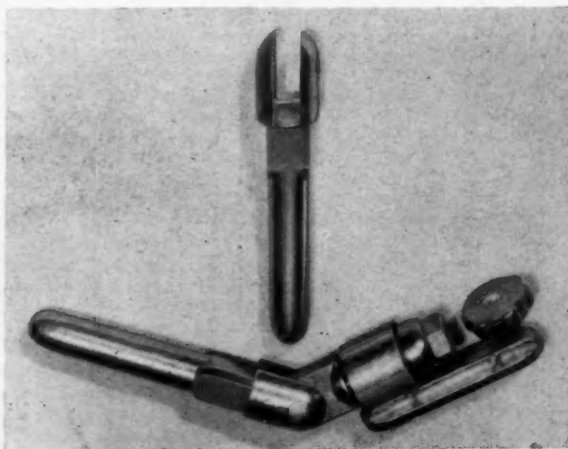
This firm specialize in the production of yacht and dinghy fittings, pressure die-cast in aluminium alloy, marketed by J. Holt Ltd., under the name Holt-Allen fittings. They are mainly L33, and by reason of the limitations of the market for these products, they have had to develop

along rather specialized lines. Despite the tremendous increase in the popularity of small boat sailing, the consumption of dinghy fittings is small. During the years immediately following the war, the production of sailing dinghies was negligible, and it was not until the advent of the cold setting waterproof glues and the boost given to home boat building by the yachting press that the numbers of boats being built annually began to show any



Left: Fig. 1—Two examples of pressure die-cast bow plates

Below: Fig. 2—Gooseneck fittings; these hinged assemblies are fitted to the mast and carry the boom



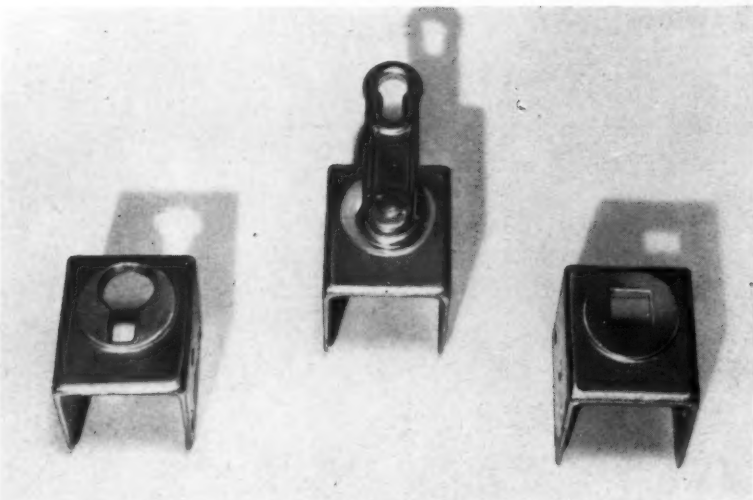


Fig. 3—Boom fittings. The die for these takes interchangeable inserts to suit varying types of attachments for the kicking strap

Fig. 4—Some of the Holt-Allen range of rudder and transom fittings

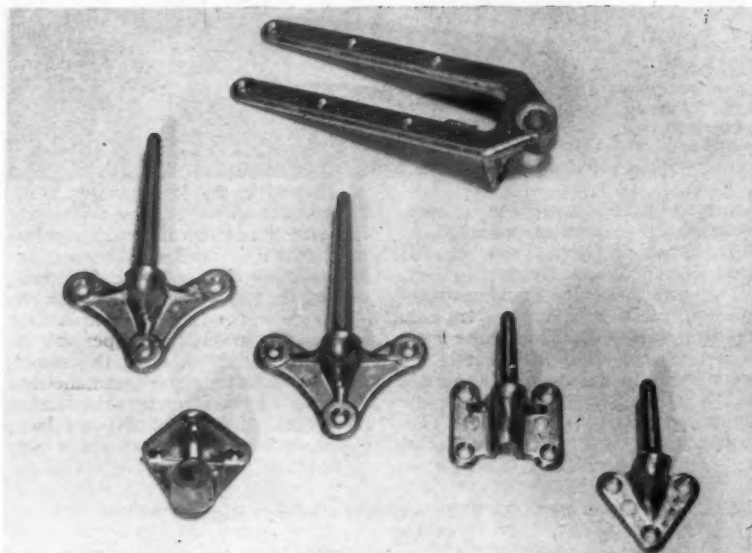


Fig. 5—Mast fittings. Thin walls and nylon sheaves are features of these parts

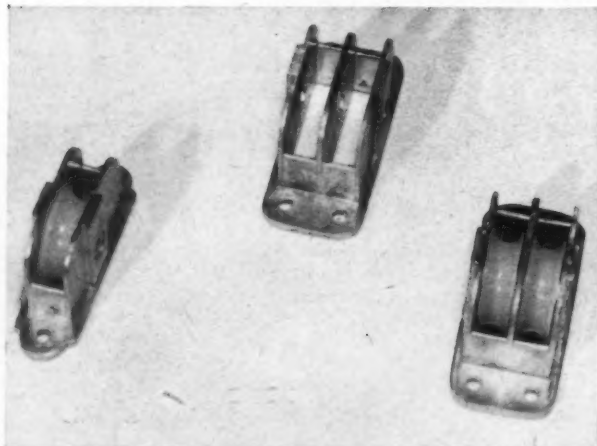
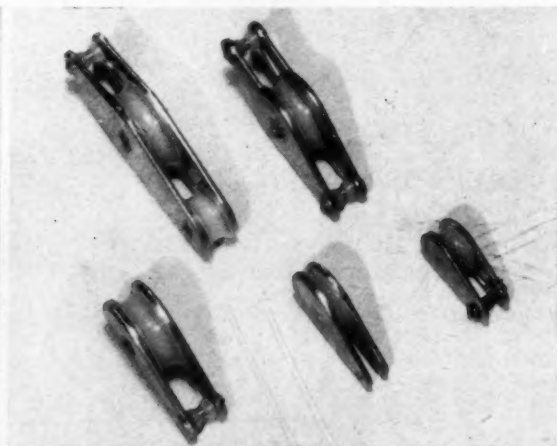


Fig. 6—A range of many sizes of blocks is manufactured by Allen Bros. some of which are shown here



marked increase. Last year, something over 4,000 dinghies were built in this country, and there is evidence to suggest that the number this year will considerably surpass that figure. Even so, many types of boat are included, and the range of small boat fittings is far from standardized. Thus, the market for a particular design of bow-plate or gooseneck, for example, may not reach four figures in any one year.

A further consideration, and one which has limited the extensive adoption of pressure die-cast fittings, is the conservative outlook of many boat-yards; accustomed to brass and bronze, with a grudging acceptance of reinforced plastics such as "Tufnol," they are in no hurry to recognize the advantages of aluminium fittings.

That these advantages are real will be seen from the descriptions of some of the parts produced by Allen Bros. In almost all of them simplicity is the keynote, and it is the careful adherence to simple forms that has enabled this firm to make an economic proposition of their production. Because the form of the components is simple it has, in most instances, been possible to use simple dies, without elaboration, in cavities, cores or cooling. Similarly, the firm has been able to design and build its own special purpose die-casting machines. By these means, and the exercise of considerable ingenuity, this small firm has been able to build up a specialized production which began three-and-a-half years ago with one machine, one crucible, and one ingot! Within the last month, new premises have been occupied and capacity expanded to deal with increasing orders, both from home and overseas.

Probably the most outstanding advantage of the pressure die-cast aluminium boat fitting, apart from reduced cost, is its lighter weight. In small craft, particularly racing dinghies, this means a great deal, since every ounce above the water line lessens stability as well as adding to the load.

The bow plates shown in Fig. 1 are

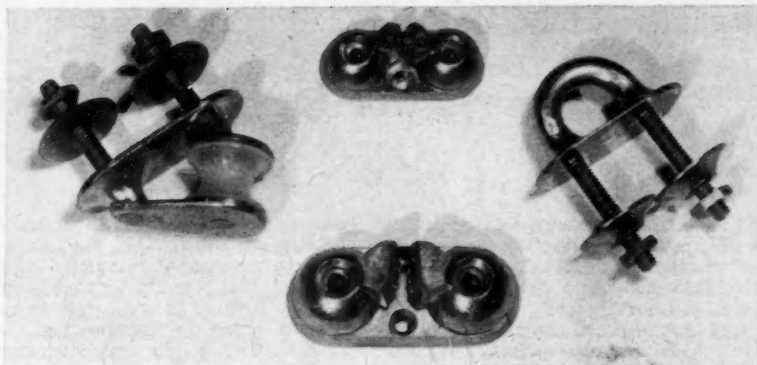
good examples of weight-saving components. These were previously made in sand cast bronze, the section being heavier and the plate itself, in the case of the casting at the lower right, longer and wider. Since the main strain (that of the forestay) is taken in an upward direction by the eye at the forward end, any extension of the plate rearwards adds little to the security of the plate on the deck, and nothing to the useful strength of the plate. By redesigning the component as in Fig. 1, with screw holes well forward at either side of the eye, the maximum security has been obtained, while the length has been reduced. As an aluminium die-casting the weight is a little over 2 oz. The other bow plate in Fig. 1 has an extension rib which is secured to the stem of the dinghy, the die-casting being similar to the original sand-cast bronze product, except for its weight and, of course, the fact that no drilling, countersinking or buffing is required on the die-cast component.

In Fig. 2, a fairly typical gooseneck fitting is shown. This is the fitting that carries the boom of the dinghy, being secured to the channel track in the mast by the slide at the right-hand side and the thumbscrew. In this design, the gooseneck stem is hinged by a rivet, permitting swivelling in the vertical plane, and movement in the horizontal plane is provided by the swivel fitting that passes through the boss on the mast slider. In this assembly, there are five small die-castings. The stem has a square shoulder on which the boom locates, to prevent turning, and a hinge slot at its inner end. The swivel fitting, whose tongue lies in the hinged slot and is secured by a rivet, has a tapered shank threaded at its end. This shank fits within the boss on the gooseneck slide, which is bushed with a nylon bearing, and is held in place by a die-cast collar backed by a stainless steel nut.

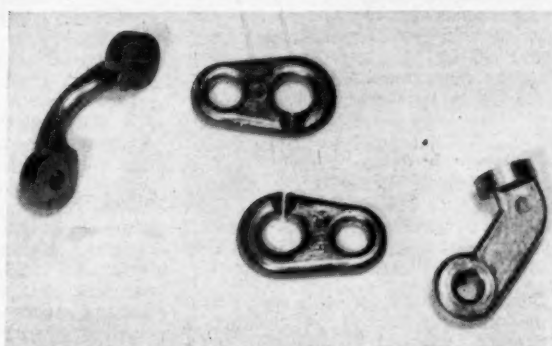
The three fittings in Fig. 3 are boom fittings, all produced from the same die but using, in each case, a different insert to form the fastening for the kicking strap. In the one case, a key-hole shape is cored out, in another a square, and in the third a boss and cast-in rivet are incorporated to provide a fixing for the die-cast arm.

The castings in Fig. 4 are rudder and transom fittings; all have cast-in countersunk screw holes, the upper and lower ones having nylon bushes. As in the case of the bow plates, these have replaced parts cast in bronze, and the saving in weight alone is a major advantage.

Mast fittings of the type shown in Fig. 5 have particular advantages as die-castings, because not only is there saving in weight by the use of aluminium, but it is possible to use much thinner walls, and the smooth finish of the die-casting eliminates machining of the inner walls. Nylon sheaves are



Above : Fig. 7—Fairleads (right and left) and cam-type jamming cleats (centre)



Right : Fig. 8—Spinnaker clips (centre), kicking strap key (right) and lacing eye (left)

used, mounted on a hollow aluminium pin.

Similar considerations apply to some extent to the blocks shown in Fig. 6, although many of those in use have been made of a laminated plastics material of the Tufnol type, reinforced with a side strip of brass. In these die-castings, the spindles for the larger sheaves (wheels) are cast-in as hollow tubes, being spun over the opposing side plate on assembly. The becket bushes (smaller wheels) are mounted on stainless steel screws. In order to minimize weight, while maintaining rigidity, the side plates are made as thin as practicable except at the sheave bosses and at the edge, around which runs a rib of the same height as the bosses.

The fittings on the right and left of Fig. 7 are fairleads. They have cast-in stainless steel screws, for fitting down to the deck, and the roller type (left) has a nylon sheave, over which the sheet can run freely. The other two fittings are cam cleats, designed to allow a rope to be locked against strain in one direction, but also permitting immediate release. In each of these there are two toothed cams, pivoted and spring loaded, and, when finally assembled, secured in position by screws. As they lie in the illustration, a rope between the jaws could be pulled through in an upward direction, but would immediately lock if drawn downward.

This type of fitting has frequently been made from Tufnol, but the wearing characteristics of the toothed jaws are much better in the die-cast aluminium fitting. Because of the

ability of die-casting to include location pins for the springs on both base and cam, and the complete absence of machining, the aluminium product is a much more economic production.

Four other small castings are shown in Fig. 8. Those in the centre are spinnaker clips, and provide a rapid means of attaching two ropes, the vee notches in each allowing the eyes to be interlinked or freed instantaneously. The other two castings—the kicking strap key on the right and the lacing eye on the left—are typical of the many small parts in the Allen range.

All these die-castings are simple forms, all purely functional, and in each case the design has been centred around these two aspects. The close attention given to the requirements of small-scale production, the judicious design of simple tools, and the employment of specialized but simple machines, has made possible the introduction of these die-castings to the small boat market, providing the dinghy sailors with lightweight interchangeable fittings at a reasonable price.

Cobalt

A NEW reference bibliography, "Cobalt and Its Alloys, a Summary on Allotropy and Phase Diagrams," has recently been published by Le Centre d'Information du Cobalt, 35 rue des Colonies, Brussels, Belgium.

The 125-page bibliography contains several hundred references to cobalt literature, as well as two-colour phase diagrams of numerous alloy systems.

RECENT WORK ON RELATION BETWEEN PRESSURE AND PLASTICITY

Plasticity of Brass

By P. G. MORGAN

EFFECTS of very high pressures on the mechanical properties of metals have been widely studied by Bridgman,¹ and one general conclusion from his work is that when a very high pressure acts on a deforming metal, the plasticity is greatly increased. His experiments on various steels in extension tests were carried out with hydrostatic pressures ranging from 1 to 30,000 kg/cm², and the true deformation measured in each case. The true deformation A is given by

$$A = \log_e \left(\frac{S_0}{S_p} \right)$$

where S_0 = cross-sectional area of specimen initially.

and S_p = cross-sectional area of neck of specimen after fracture.

Bridgman found that this true deformation at the neck of the specimen at rupture increased linearly with pressure, and led to the statement "There is at present no indication that the pressure-plasticity relation will cease to be linear at pressures substantially greater than those used here."

For other metals in tensile tests, comparatively little work has been done at high hydrostatic pressures. Bridgman gives some data² on the stretching and fracture of aluminium, copper, brass, bronze, beryllium, phosphor bronze and cast iron; it was found that even metals which are brittle at atmospheric pressure, such as cast iron, show greatly increased plasticity, but few experiments were carried out. The only pressure-fracture deformation curve available is that for tungsten, from which it may be inferred that the plasticity of tungsten increases approximately linearly with pressure.

Ratner^{3,4,5} has described preliminary Russian work on the mechanical

properties of metals at hydrostatic pressures of 1 to 4,000 kg/cm², showing an increase of plasticity with pressure, but, recently, further work on non-ferrous metals has been reported,⁶ with pressures up to 30,000 kg/cm², to determine whether the linear true deformation-pressure relationship holds for other metals than steel.

The work so far reported has been done with brass of composition: 39.5 per cent zinc, 0.16 per cent lead, 0.05 per cent iron, balance copper. The equipment used is similar to that of Bridgman, with specimens 4 mm. in diameter and a cylindrical section of length 12 mm. stretched to breaking point at various pressures up to 30,000 kg/cm²; since the pressure rises by some 8 to 10 per cent in the course of stretching, the pressure at which fracture occurs is measured.

All the specimens tested showed considerable necking and noticeable slip lines, while the fractures had the appearance of tears at 45° to the axis of the specimen. The necks of specimens fractured under pressure are much thinner than those tested at atmospheric pressure, showing considerable increase of plasticity with pressure.

Specimens prepared from the fractured bars for examination by microscope show that at atmospheric pressures, the crystals at the centre of the neck are only slightly extended along the axis of the specimen, but, on

the other hand, high pressure specimens show that considerable axial extension has occurred.

The relation between the true deformation A and the applied pressure is shown in Fig. 1. Between 0 and 3,000 kg/cm² the plasticity increases rapidly, but above 4,000 kg/cm² the rise ceases and a saturation value is approached. Thus, from 1 to 4,000 kg/cm² A rises from 0.35 to 1.35, while over the remainder of the range up to 30,000 kg/cm² the true deformation does not exceed 1.65.

It will be of interest to see if this new type of pressure-plasticity relation is exclusive to brass, or is generally applicable to other metals. In any event, these results indicate that Bridgman's assumption of a linear relation between plasticity and pressure being true above 30,000 kg/cm² may be suspect, and will probably lead to extended work in this field.

References

- 1 P. W. Bridgman; "Studies in Large Plastic Flow and Fracture," 1955.
- 2 P. W. Bridgman; "Properties of Certain Metals and Other Materials on Extension under Pressure." Appendix to Ref. 1.
- 3 S. I. Ratner; "Strength and Plasticity in Metals" (in Russian), 1949.
- 4 S. I. Ratner; *Zh. Tek. Fiz.* (U.S.S.R.), 1949, 19, 408.
- 5 S. I. Ratner; *Izv. Akad. Nauk. S.S.S.R., Otd. Tek. Nauk.*, 3, 435.
- 6 Yu. N. Riabinin, L. D. Livshitz and L. F. Vereshchagin; *Zh. Tek. Fiz.* (U.S.S.R.), 27, 2156.

Canning Uranium

SUCCESSFUL canning of uranium for use in the fuel elements of gas-cooled reactors has involved a variety of technical problems. For example, uranium, when raised to high temperatures, swells and bows irregularly. It is essential that the containing can should follow the contours of the uranium without failing to sheathe it while still retaining the various technical properties which are required. This is one of the problems to which a solution was sought in order to provide an adequate service life for fuel elements. Because of the need to minimize the frequency with which elements are changed, and to avoid as far as possible the failure of any one element, various metals were tried in an endeavour to find the most suitable canning material.

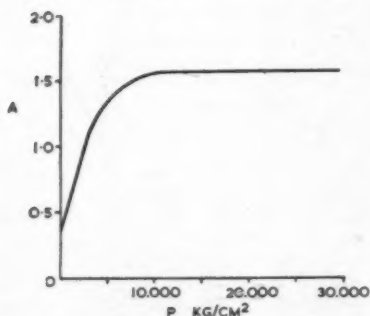
Combined research carried out by A.E.R.E., Harwell, and Magnesium Elektron Limited, Manchester, even-

tually led to the development of a magnesium alloy of suitable properties, and a patent was taken out (British Patent No. 776,649) in the names of R. A. U. Huddle, J. Laing (of A.E.R.E.) and A. C. Jessup and E. F. Emley (of Magnesium Elektron Limited). This alloy was called "Magnox," and in the Calder Hall reactor the fuel elements are all canned with this alloy, the usual version of which is A.12.

Initial service experience with cans of this type has been very satisfactory and it was found that when the cans were examined after a run of ten months, only 10 out of 10,000 used had failed.

It has been shown that the gas-cooled reactor can be operated commercially for the generation of electricity, and there seems every probability that magnesium will be widely used in applications of this kind for several years.

Fig. 1—Relationship between true deformation and applied pressure



Research Progress

High Temperature Sources

BY RECORDER

METALLURGISTS are usually accustomed to working with processes demanding the use of elevated temperatures, since many methods of extracting metals, and of forming and treating metals, involve temperatures commonly approaching 1,000°C. and often lying in the range 1,000°-2,000°C. The need for temperatures exceeding this latter value has been limited, however, but in recent years interest in high melting point metals such as molybdenum, the development of cermets and so on, has increased their use considerably. The production and control of such high temperatures has been studied in the High Temperature Laboratory of the Research Institute, Temple University, Philadelphia, and some of the work carried out since the establishment of the Laboratory in 1948 has been described recently by A. V. Grosse and J. B. Conway.¹

Chemical Reaction

Among the methods available for the production of high temperatures, perhaps the most frequently used are those depending upon the heat liberated by chemical reactions. For several practical and economic reasons, one of the reactants is usually air or oxygen, and the temperatures attainable are governed primarily by the heat of formation of various oxides, notably H_2O and CO_2 . Several metals also react with oxygen, however, with a consequent energy release approaching that obtained when more conventional reactants, e.g. hydrogen or acetylene, are oxidized. Thus, for instance, the oxidation of 1 lb. of acetylene gives rise to a little over 21,000 B.Th.U., that of 1 lb. of beryllium to over 24,000 B.Th.U., and that of 1 lb. of aluminium to more than 13,000 B.Th.U.

The heat available is, of course, not the only factor determining the temperatures that can be reached, since these will be influenced by heat losses to the surroundings and to changes of state of the reactants or reaction products. Grosse and Conway also discuss the effects of reaction product stability, but without relating this to the heat of reaction—a separation that appears to be artificial. They point out rightly, however, that for systems in which the metal oxide decomposes at a specific temperature, then temperatures greater than that value are not obtained. For this reason, the combustion of the alkali metals is likely to be of little interest, the oxides all decomposing at about 2,600°K. or lower.

These principles were demonstrated in experiments in which aluminium, contained in a pot furnace, was ignited in an atmosphere of oxygen. At "low" rates of oxygen feed, a steady condition could be obtained in which a pool of burning aluminium floated on the molten reaction product (i.e. Al_2O_3 , m.p. c. 2,300°K.). Since the oxide is more dense than the metal, it does not impede the reaction, which proceeds at a linear rate provided the oxygen supply is maintained constant and the aluminium is replenished at a suitable rate. Increasing the rate of oxygen supply caused an increase in the temperature of the pool to the melting point of the metal (c. 2,500°C.) and turbulent conditions were set up above the pool, large quantities of alumina smoke being generated. For stable operation, then, pool temperatures were limited to about 2,500°C., though the flame temperature above a boiling pool approached 3,500°C. at 1 atm. pressure. This latter value could be increased (to 4,100°C. at 10 atm.) by increasing the pressure, since the flame temperature is controlled by the dissociation temperature of alumina—a pressure dependent property.

The limitations to steady operation of the arrangement described are enhanced in other systems in which the metal may be denser than its oxide or have too low a boiling point. Beryllium-beryllia has similar characteristics to aluminium-alumina, but in the zirconium-zirconia system, for instance, the oxide is less dense than the metal, and the high boiling point of zirconium could not be utilized.

Presumably in an attempt to take advantage of the high flame temperatures of the aluminium-oxygen reaction, Grosse and Conway ignited aluminium in oxygen in a horizontal cylinder lined with alumina, which was then rotated at 300 r.p.m. Further aluminium was added until the whole of the inner wall was covered with burning metal. The temperature readily attained the boiling point of aluminium, but at oxygen rates high enough (say 300 L./min.) to cause substantial boiling the intense heat of the flame rapidly eroded the material round the exit port of the tube.

It will be clear that in the above experiments ignition precedes or initiates combustion, this point being reached at the temperature at which the heat liberated in the reaction exceeds that lost to the surroundings. The authors are strongly of the opinion that the ignition temperature "should be a characteristic property of the metal, similar to melting point, density,

and tensile strength." The term "characteristic property" is here used in a misleading sense, and this special pleading is hardly likely to succeed when it is known that in cases such as that of zirconium, the "characteristic" ignition temperature can vary by at least 1,000°C. depending on whether the metal is in massive or powdered form. Grosse and Conway measured the ignition temperatures of a number of metals by holding 10 gm. samples at various controlled temperatures in oxygen and observing whether or not combustion occurred. The results obtained were shown to exhibit a general periodicity, according to atomic number, similar to that given by heats of formation of metallic oxides. The former trend can surely be predicted from the latter, and this being so, some anomalous values (that for strontium being considerably higher than those of other Group II metals) afford examples of the variability of ignition temperatures likely to be obtained in measurements of this type.

Metal Powder Flames

The Paper is concluded by a section on powdered metal flames. These were obtained by entraining powders of less than 200 mesh in a stream of oxygen and igniting the mixture (usually with a pilot flame sheathing the central exit tube for the mixture). Aluminium, magnesium, iron, manganese, silicon, titanium, zirconium, calcium, and various alloy and carbide powders were tried, but details are given of the combustion of only the first two of these. Central tube diameters between $\frac{1}{8}$ in. and 1 in. were used with streams carrying 50-550 gm. metal/min. The linear velocity of the stream was limited by "flash back" at low values, and by a "blow-off" or a change in the nature of the flame at high values. Thus, for Alcoa 101 aluminium powder, these extremes were at about 20 ft/sec. and 300 ft/sec. respectively. With a finer powder (4-6 microns), velocities up to 975 ft/sec. could be used without deterioration of the flame quality. The powder:oxygen ratios appear to have been based invariably on the stoichiometric amount of oxygen required for complete oxidation of the powder and the flame length and diameter (ranging from 1-12 in. and $\frac{1}{8}$ -3 in. respectively), varied by alterations in the tube size and mixture velocity.

The aluminium:oxygen flame was capable of giving temperatures exceeding 3,000°C., and was thus effective in penetrating highly refractory materials,

particularly since the reaction product, alumina, is probably produced partly in molten form, and hence able to give a slagging action to the flame. In fact, a notable difference between this behaviour and that of a magnesium-oxygen flame could be attributed to the closeness of the flame temperature to the melting point of magnesia. In this case, the reaction product tended to build up as a powdery mass on the surface exposed to the flame, and thus gave an insulating protection. The addition of silicon powder to the

magnesium allowed the formation of magnesium silicate and the penetration rate was thereby increased very considerably, this compound having a much lower melting point than magnesia. The erosive nature of the reaction product of metal:oxygen flames can clearly give the method unusual advantages.

Reference

- ¹ A. V. Grosse and J. B. Conway; *Industrial and Engineering Chemistry*, 1958, 50 (4), 663.

Electrorefining Titanium

A SERIES of tests on the electrorefining of titanium from binary alloys has been carried out by J. R. Nettle, T. E. Hill, Jr., and D. H. Baker, Jr., and the results published by the U.S. Bureau of Mines.

The investigations were exploratory in nature, as all variables that might influence alloy-element transfer were not examined. The tests show that titanium can be refined almost completely from molybdenum, tin, and zirconium; that refining from aluminium and chromium is only slightly less successful; and that refining from vanadium, and especially manganese, is relatively poor. It was also shown that a readjustment of operating variables or conditions is required to prevent electrowinning of titanium when it is refined from molybdenum and aluminium. Changes in operating conditions are indicated if refining of titanium from aluminium, chromium, and vanadium is to be complete. The fact that manganese contaminated both the electrolyte and the sublimates that collect in the cold zones of the cell, indicates that refining titanium from an alloy containing manganese will not be successful unless some means is

found to render the manganese electrically and chemically inert. However, tests of the manganese alloy indicate that a manganese alloy of any desired composition could be deposited if enough soluble manganese were present in the electrolyte.

Removal at regular intervals of the scale formed on the anode during electrolysis is desirable. The blanketing effect of the scale has three possible detrimental consequences: it can lower the cathode current efficiency, increase the tendency of alloying elements to transfer, and increase the danger of electrowinning of titanium from the electrolyte.

Of interest is the fact that the deposits recovered were much softer than the original material, regardless of the alloy tested. The reduction in hardness is due largely to the elimination of interstitials and iron, which makes the electrorefining process desirable for purifying other alloys. Although the quantity of an alloying element might transfer unchanged, the purification of alloy scrap by electrorefining would be economically sound if a product were acquired whose ductility had been restored.

Patternmaking Resins

IN the manufacture of press tools, foundry patterns, jigs and moulds from Bakelite epoxide resins, a method widely used is that in which a non-draining thixotropic facing coat of filled resin is applied to the pattern, allowed to body, and backed by a casting or laminate. The facing coat formulation consists of a mixture of resin, filler, thixotropic agent and hardener which have hitherto been supplied separately and mixed prior to use.

To simplify the process and reduce the amount of handling involved by users, Bakelite Limited are now marketing DR.19114, which is a pre-mix of epoxide resin, slate dust filler and Aerosil thixotropic agent.

Work carried out in the company's laboratories has resulted in the

development of a new reactive flexibilizer DQ.19116. This is a modified amine designed to obviate handling difficulties. It has little odour; is miscible with most of the normal hardeners used with epoxide resins, and gives mixes of low viscosity which can be poured easily.

A new hardener, DQ.19117, has also been introduced for use with R.18774/1 resin. The combination of resin and hardener gives a cold setting system which may be used in casting, laminating, as an adhesive, or as a brush setting cement.

These three new products and their methods of application are described in detail in three advance information sheets, Nos. E23, E28 and E29, obtainable from the company at 12-18 Grosvenor Gardens, London, S.W.1.

Men and Metals

In succession to **Dr. W. E. Smith**, who has retired but will remain on the board, **Mr. H. F. Wilson** has been appointed managing director of the cables group of the Telegraph Construction and Maintenance Co. Dr. Smith is to act as a consultant for Submarine Cables Limited, of which company he is also a director.

It has been announced by the Birfield Group that **Mr. G. W. Kelland** has been appointed public relations officer to the group.

Due to health reasons, **Mr. W. M. Warren** has resigned from the board of the London Tin Corporation and its subsidiary, Anglo-Oriental and General Investment Trust.

Staff appointments in their engineering department are announced by Edgar Allen and Company Limited as follows:—**Mr. J. Higginbotham** as deputy general manager; **Mr. J. D. Studholme** to be assistant general manager; **Mr. A. Brunton** to be commercial manager; **Mr. A. Wallis** to be chief draughtsman (production); **Mr. J. D. Lee** to be chief draughtsman (development); and **Mr. S. Carter** to be chief estimator.

Fourth member of his family to hold the office, **Mr. J. H. Neill** has been elected Master of the Sheffield Cutlers Company. He is deputy chairman and joint managing director of James Neill and Co. (Sheffield).

Principal scientific officer, Chemical Inspectorate, Ministry of Supply, **Mr. G. F. Reynolds**, M.Sc., F.R.I.C., has accepted the chairmanship of the Technical Advisory Panel of the British Polarographic Research Institute. **Mr. W. J. Parker**, B.Sc., A.R.I.C., A.M.Inst.F., secretary of the Institute, has resigned his appointment with Mervyn Instruments in order to devote more time to the development of the Institute, but he will continue to act as polarographic consultant to that company.

New joint research projects under the direction of the Industry Development Committee of the American Zinc Institute and the Lead Industries Association, are to be managed by **Dr. S. F. Radtke**. Dr. Radtke has been, until now, director of the metallurgical research laboratories of Reynolds Metals Co.

Director of the Solartron Electronic Group and managing director of its subsidiary, Solartron Electronic Business Machines, **Mr. Bowman Scott** is on a seven-week visit to the United States and Canada for the purpose of discussing with customers their various requirements in order that their representatives may visit the group's new works at Farnborough in December and January next, for consultation on production models.

Industrial News

Home and Overseas

Jewellery Trade Fair

Precious metals will be among the many items featured at the Fourth International Watch and Jewellery Trades Fair, to be held at the Royal Albert Hall, London, from September 29 to October 3. The fair is sponsored by the National Association of Goldsmiths, and exhibits will include costume jewellery, men's jewellery, clocks, and a range of fancy goods in silver and other materials.

Electric Furnace Elements

Several of the applications of "Crusilite" electric furnace elements will be shown on the stand of the Morgan Crucible Company Ltd. at the Electro-Heat and Productivity Exhibition and Conference, to be held at the Kelvin Hall, Glasgow, from November 10-14. Among the applications for these elements are the following: experimental heat-treatment; assaying; refractories research; sintering; continuous casting; copper brazing; zone refining; billet heating, and general melting.

Metal Merchants' Golf

Final arrangements have now been completed for the Autumn Meeting of the National Association of Non-Ferrous Scrap Metal Merchants' Golfing Society.

The dinner will be held at the Welcombe Hotel, Stratford on Avon, on Wednesday, October 1, at 6.45 p.m. for 7.30 p.m. (Not evening dress. No guests).

Golf will be played on the following day at the Stratford on Avon Golf Club, beginning 9 a.m. sharp. Two rounds will be played. In the morning a medal round for the Captain's Cup (this may be altered to a Stapleford Competition), with the veterans also playing for the "Ellis-Masur" Veterans' Cup. In the afternoon there will be a foursome competition against bogey for the "Autumn Green-some Cup."

Members are requested to make their own arrangements for partners for the morning round. The secretary would like to know as soon as possible, and in any case not later than Thursday, September 25, those members who will be present for the dinner, and those who will be taking part in the golf.

Notification should be sent to G. B. Garnham, G. B. Garnham and Sons Ltd., Plantation House, Mincing Lane, London, E.C.3.

Isotope Production

An agreement covering a ten-year period for the manufacture and supply of Boron 10, a stable isotope used in nuclear power production, has been signed between the United Kingdom Atomic Energy Authority and 20th Century Electronics, of New Addington, Croydon. The latter company will be able to sell surplus Boron 10 and Boron 11 provided the Authority's requirements are met.

Bright Tin Plating

Following the successful introduction by the Tin Research Institute some time ago of a satisfactory bright tin plating process, commercial development is now under way. A process for the manufacture of the brightener has been introduced

by Shirley Aldred and Co., and the two compounds used are to be made available by Sonic Engineering and Equipment, 120-130 Parchmore Road, Thornton Heath, Surrey. The name Brytin has been given to the process.

Australian Headquarters

A new headquarters in Australia for the Shell Company of Australia is to be built. It will have 19 storeys, will be 233 ft. high, and have glass and aluminium curtain walls on all four sides.

Electroplating in Wales

A plant which will enable much greater output to be realized by Pilkington's Plating (Cardiff) Ltd. has been installed at Whitchurch, Cardiff. The firm, which is a subsidiary of the Concordia Electric Safety Lamp Co., is engaged in copper, nickel, chrome and silver plating.

Pakistan Copper Enquiry

We have been informed by a manufacturing firm in Pakistan that they have been granted an import licence for electrical copper wirebars and ingots, 99.9 per cent, to the value of £900.

We shall be pleased to furnish the name of this firm to any interested parties.

New Nickel Company

A new mining company, the North American Nickel Company, has been incorporated in Delaware, U.S.A. It combines the resources of St. Joseph Lead Company, Bunker Hill Company, Falconbridge Nickel Mines Limited, and Blyth and Company.

The new mining company has not as yet made any bids on properties, but it has several sites under consideration, according to trade sources. Another possibility is that the new company will bid for the Government-owned nickel plant near Nicaro Cuba, with the idea of selling the nickel produced in Europe.

Non-Ferrous Club

At the September meeting of The Non-Ferrous Club, last week, the guest speaker was Mr. R. G. W. Plutte, managing director of the London Zinc Mills Limited. Commenting on his recent visit to America and Canada, he said that he went there expecting to find them well ahead in their technical processes. This expectation was not, however, fulfilled, for he found that although most American zinc rolling firms were in advance of those in this country as far as the rolling of strip was concerned, in the rolling of sheet our methods were years ahead of those generally used in the U.S.A. Comparing productivity, he found that, generally speaking, we were 25 to 30 per cent up on productivity per man/hr. In one respect the market differed: there was a very large American market for strip, and he thought that a similar market might be developed here. Regarding applications of zinc, American industry did not quite know where it was going, and they could learn from us and from the Zinc Development Association in this respect. There was, he said, much more direct selling in America, and merchants were not so widely used, and, of course, there was the fixed price.

In Canada, he found business men interested in buying from the United Kingdom, but the market for zinc was localized around Toronto and Montreal, and on-the-spot selling was essential. He thought the Canadian market was expanding, and if they made the effort United Kingdom suppliers could beat those in the U.S.A. and reap substantial rewards if they could meet the new specifications which were being introduced.

At this meeting the club's golfing trophy—the Metal Industry Cup—was presented to Mr. S. H. Hoskison, of Beebee Brothers, who was unable to receive it on the day of the tournament.

A collection on behalf of the National Federation of Boys' Clubs was taken, and realized £16 10s. 0d.

Luncheon Club

Opening with a meeting on October 16 at the usual venue of the Rembrandt Hotel, Thurlow Place, Kensington, S.W.7, the new session of luncheon meetings of the Finishing Luncheon Club will again provide a series of opportunities for those interested in any aspect of industrial finishing to meet in congenial surroundings and discuss matters of common interest with other members of the club and their guests.

Provisional dates for subsequent meetings are December 18, and February 19 and March 19, 1959.

A New Depot

It has been announced by British Insulated Callender's Cables Ltd. that they will open a new depot at Oakcroft Road, Chessington, Surrey, on Monday next, September 15. The stocks to be held will include a comprehensive range of rubber, thermoplastic and mineral insulated cables and accessories. The new depot will be in charge of Mr. H. M. Hudson, who has been with the company for twenty-five years.

Annual Ball

Birmingham will, as usual, be the venue of the twenty-first annual ball of the Royal Metal Trades' Pension and Benevolent Society (Midlands Area), which will be held at the Grand Hotel, Birmingham, on Thursday, October 9 next, from 8.30 p.m. until 1 a.m. The price of the tickets is 30s. each, and these may be obtained from the local secretary, Mr. E. S. Tranter, 151-3 Edmund Street, Birmingham, 3.

Analytical Chemistry

An ordinary meeting of the Midlands Section of the Society for Analytical Chemistry will be held on Tuesday next (September 16) in the Mason Theatre, The University, Edmund Street, Birmingham, 3, at 6.30 p.m.

Uses of Glycerine

Besides being a long-established ingredient in hundreds of products in a wide variety of fields, glycerine is constantly finding its way into new and improved products. At the present time, glycerine is an ingredient in over 1,700 processes and compositions, which are

listed in a new booklet issued recently by the **U.K. Glycerine Producers' Association Ltd.** Copies of the booklet are available on request from the association at 5 Bridewell Place, London, E.C.4.

Refresher Courses

Inaugurated by the **Incorporated Plant Engineers**, the next of their comprehensive refresher courses for senior works and plant engineers is to be held this winter at Liverpool University. It will comprise 18 weekly lectures on Thursday evenings, commencing on October 30 next.

The fee for the course is four guineas, and copies of the syllabus and full particulars may be obtained from the secretary to the refresher course at The Donnan Laboratory, Vine Street, Liverpool, 3.

Aluminium Roofing for Shelters

Some of aluminium's advantages as a roofing material are illustrated in the range of C.O.I.D.-approved unit-system bus shelters manufactured by the North Midlands Engineering Co. Ltd., of Skegby, Sutton-in-Ashfield, Notts. The shelters were designed by D. R. Mellor, D.E.S., R.C.A., largely with an eye to appearance, bearing in mind that they are invariably erected in prominent places. In addition, durability and ease of erection were important.

Two types of shelter are available: an open type for city use and a more closed-in type for rural areas. The parts are supplied ready for assembly, steel components being hot dip galvanized and painted to customers' specifications. A typical three-section shelter can easily be erected by two men in one day. Painted steel supports, kick panels and roof brackets are employed, the glazing usually being $\frac{1}{8}$ -in. plate Georgian-wired glass or $\frac{1}{8}$ in. armoured glass. The roof is Noral 20 S.W.G. aluminium industrial sheet supplied by **Northern Aluminium Company Ltd.**

Rhodesian Copper Output

Production of copper at the Roan Antelope Mine in Rhodesia in the final quarter of the year ending June 30 totalled 19,716 long tons, bringing the total for the year to 79,931 tons. Output in the previous year totalled 86,294 tons, the company announced in its quarterly report.

Output at Mufulira Copper Mine in the June quarter of 1958 totalled 23,508 long tons, bringing production for the year to 92,904 tons, against 99,793 tons in 1957. Chibuluma Mines Limited produced 5,237 long tons in the June quarter, giving a yearly production of 27,177 tons, against 14,494 tons in the previous year.

Lead-Zinc Research

Research into lead and zinc utilization is being sponsored by 19 lead and zinc producers of four continents, it is reported from U.S.A. During last week-end the producers, through their trade associations, appointed Dr. S. F. Radtke, former director of the metallurgical research laboratories of the Reynolds Metals Company, Richmond, Virginia, as head of their research programme. Dr. Radtke said the programme undertaken would serve to adapt the properties of the two metals to the latest technical advances. It would help them to take part in the rapid development of new ideas, industries and services to the consumer.

The supporting producers are: American Metal Climax Incorporated; American Smelting and Refining Company; American Zinc, Lead and Smelting Company; The Anaconda Company; Athletic Mining and Smelting Company; The Broken Hill Associated Smelters Pty. Ltd. (Australia); The Bunker Hill Company; Cerro de Pasco Corporation; Combined Metals Reduction Company; Consolidated Mining and Smelting Company of Canada Ltd.; The Consolidated Zinc Corporation (England); The Eagle-Picher Company; The Electrolytic Zinc Company of Australia; Hudson Bay Mining and Smelting Company Ltd.; Mattiessen and Hegeler Zinc Company; National Zinc Company; The New Jersey Zinc Company; St. Joseph Lead Company; United States Smelting, Refining and Mining Company.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week totalled 17,152 tons, comprising London, 6,104; Liverpool 9,563, and Hull, 1,485 tons. Copper stocks totalled 11,031 tons, and comprised London, 5,549; Liverpool, 5,207; Birmingham, 75; Manchester, 50, and Swansea, 150 tons.

Remote-Controlled Annealing Furnace

To meet the specific problem of high-temperature tube annealing, a remote-controlled gas-fired roller hearth furnace has been installed by **Birlec Limited** at the works of Talbot Stead Tube Ltd., at Walsall. Designed for the treatment of stainless steel tube, the furnace comprises a loading table, pressurized chamber, spray quench booth, and unloading table. Six Warner electromagnetic clutches and two brakes are used to provide remote control, and Honeywell-Brown pneumatic instruments are used to control temperature and pressure. Capacity is 1 ton/hr., tubes up to 40 ft. long and 8 in. diameter being accommodated.

The photograph on this page shows

the inlet door end of the furnace. It is taken from the drive-side and shows some of the air-and-gas pipework, together with four linked proportioning valves. Overall furnace length is 165 ft., of which 43 ft. 5 in. is taken up by the heating chamber shown.

Corrosion Congress

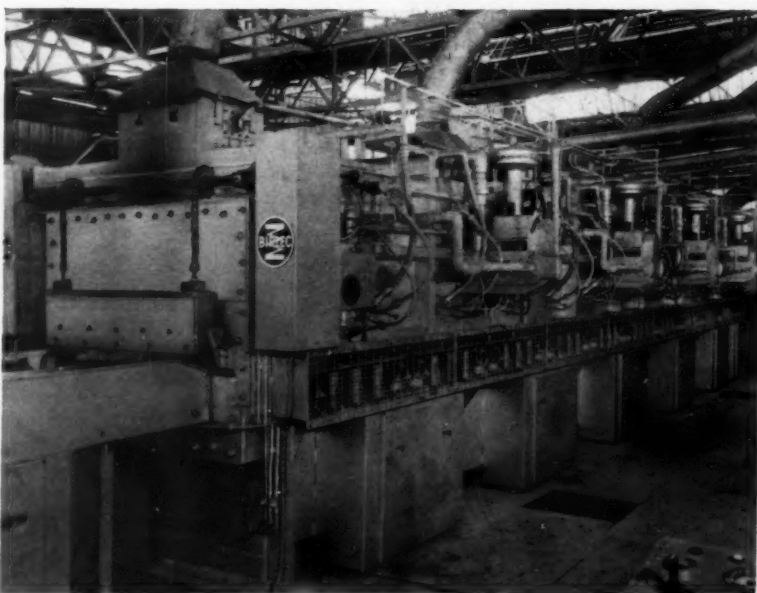
This month sees the holding of a Congress on Corrosion in Budapest at which a number of Papers on the subject of corrosion in its many aspects are to be presented. The congress will open on September 24 next and continue until September 30. The lectures will be given in Hungarian and at the same time projected from slides in two foreign languages. Any lectures given by foreign readers will also be projected in Hungarian and in one foreign language. Among the eight works visits planned are included one to a surface finishing workshop, one to a non-ferrous metals research institute, and another to an instrument factory. Papers are being presented by visitors from Soviet Russia, Poland, the Netherlands, and Austria, as well as by Hungarian personalities.

Aluminium on Show

At the forthcoming Commercial Motor Show, which is being held in London from September 26 next until October 4, the **British Aluminium Company Limited** will be exhibiting on Stand No. 435 a range of aluminium materials for the commercial vehicle building industry, including extruded aluminium alloy sections, plain and ribbed sheet, embossed and imprinted sheet, matting, positive-grip-pattern treadplate (including the new small pattern, super purity (99.99 per cent) aluminium for trim, and aluminium alloy castings.

Applications of these materials are illustrated in body sections based on standard designs prepared by the development department of the company. An enlarged drawing of a single-decker bus framework has joints detailed in the

Inlet door end of the Birlec roller hearth annealing furnace.



actual extruded sections used. Bodies for goods vehicles are demonstrated in exhibits of constructional details as follows: a flat platform body; two riveted tipper bodies; a welded tipper body; an insulated body; a box van rear end with doors; a pantechonicon side section; a Luton front end. Manufactured vehicle components include a radiator, trim, and a number of castings.

Welding Wall Charts

A new two-colour wall chart, designed for all users of Eutectic's "low heat input" metal-joining process, is now available from **Eutectic Welding Alloys Co. Ltd.** This "daily" use chart (TIS.2646) measures 13½ in. by 18½ in. and is intended for use by the welder at his point of work. It shows under headings by base metals the most suitable "Eutectic" low temperature welding alloys for various types of work and the joints on which they are used. Performance data are given for each base metal and alloy.

Also available are two welding training wall charts for technical colleges and factory training programmes. Both measure 22 in. by 34 in., and are designed to fit into welding training programmes by providing students with clear illustrations of correct arc and oxy-acetylene welding procedures.

Foundry Technology

It is reported from New York that one of the largest and newest industrial installations for the development of advanced methods of foundry technology in the United States has been put into full-scale operation by General Electric of America. This is the Applied Research and Development Laboratory of the foundry department, which is providing the vital link between pure research developing new materials and processes, and the actual foundry use of such materials and methods as casting and improved production techniques.

The laboratory has a 9 ft. diameter vacuum degassing chamber—the first in use for foundry technology in the United States—to improve methods of eliminating gaseous impurities in molten cast metals. Other projects under way include the development of improved methods of vacuum melting and processing of cast alloys to reduce impurities and improve cast properties; improved precision casting methods; and methods for reducing the quantity of metal needed for risers in castings.

Products for Nuclear Engineering

Under this heading, **Imperial Chemical Industries Limited** have published a 24-page brochure in which they describe and illustrate their range of nuclear engineering products. The Metals Division of this company has been associated with nuclear engineering from the start. In addition to providing technical assistance, the division has supplied many components and fabricated units for the research reactors at Harwell and Dounreay, and for the plutonium producing reactors at Windscale, Calder Hall and Chapel Cross.

The present range of nuclear engineering products of the company, detailed in the brochure, include components requiring advanced fabrication techniques with long-established materials such as mild steel, aluminium and magnesium, and a wide variety of wrought products in zirconium. Reference is also made to

development work on the nuclear age metals: beryllium, niobium and vanadium. The range of fuel cans made by the division includes those in aluminium and magnesium alloys for the present-day gas-cooled reactors, and in zirconium and its alloys for water-moderated and water-cooled reactors. It is also stated that research and development are in progress on producing beryllium cans for advanced gas-cooled reactors, and niobium and vanadium cans for liquid-metal cooled reactors.

Indian Export Policy

It has been announced in New Delhi that the Government of India have freed over 200 items from control with a view to enlarging the scope for exports and keeping restrictions on them to the absolute minimum, consistent with the requirements of the country's economy.

Among the items freed from control are aluminium, brass, copper and lead.

About 100 items which were so far freely licensed, i.e. for which exporters had to take out licences without any requirement of past performance, have now been completely decontrolled. Any exporter can export any of these items without having to go through the formality of obtaining a licence and paying a licence fee. These decontrolled items include aluminium sheets and plates, pipes, and tin containers.

Several commodities which were so far on the banned list have also been decontrolled. These include antimony ores, nickel and tin ores. It has also been decided that the export of commodities like ferro manganese, which has so far been permitted only on a restricted basis, should be allowed freely.

In taking these decisions, due weight has been given to indigenous requirements. The Government hope that Indian exporters will take full advantage of these measures and utilize all available export opportunities.

Polarographic Technique

Adoption of the polarographic technique in this country appears to have been seriously handicapped by a general lack of appreciation of its potentialities, and by the absence of any central organization of specialists able to provide practical training in all aspects of polarography and capable of developing polarographic methods to suit the varied needs of industry.

It was recently decided to form a **British Polarographic Research Institute** for this purpose, and Mr. W. J. Parker, B.Sc., A.R.I.C., A.M.Inst.F., has been appointed secretary of the institute. Full details of the work of the institute may be obtained from him at 55 Oriental Road, Woking, Surrey. A technical advisory panel has been formed, consisting of specialists in various branches of polarography, all of whom have offered their services in an honorary capacity.

News from Harwell

An isotope course for company directors and executives is being held at the Atomic Energy Authority's research station at Harwell from September 23-26 next. The purpose of the course is to give information about current and possible future uses of radioisotopes in industry. Full details and application forms may be obtained from the Registrar, Isotope School, Harwell, Didcot, Berks.

It is also announced by the Authority

that they propose to move from Harwell to Winfrith Heath, near Dorchester, the whole of the controlled thermonuclear project. This work will be transferred from Harwell to Dorset during the period of 1961-63. This change will permit the development of both fission and fusion work at Winfrith, and allow room for whatever expansion of the latter is necessary in the future. It will also provide a margin for new work as yet unseen, which will undoubtedly be developed at Harwell.

Metals Conference

Talks between representatives from 40 countries began in London on Monday last on the subject of the copper situation. These talks were to have been concluded on Wednesday last and were to be followed on Thursday until the end of this week by discussions on lead and zinc. This meeting was called by the United Nations, and the elected chairman of the conference is Sir Herbert Brittain. The conference was called to review the position of the three metals concerned, and to decide whether further inter-governmental consultation or action is needed.

A New Product

We are informed by **Electrical Remote Control Co. Ltd.**, of Harlow, that they are now introducing on the market a miniature cam-operated timer, type MSC, with continuously adjustable cams and the switching capacity of 10 amps. at 250 V A.C. in each circuit, inrush current 30 amps. The company states that it believes this timer to be the smallest on the market in spite of its high switching capacity. This unit is of very small overall dimensions and, with six change-over switches, can be housed inside a space, including ½ in. spindle projection, 6½ in. by 3 in. by 3 in.

Overseas Trip

Having earlier this year, toured the middle European countries, Mr. Oliver Gregory, export sales manager of **Griffin and George (Sales) Ltd.**, has now left for the northern countries. During his tour he will call on the group's agents in Germany, Denmark, Finland, Sweden, and Norway.

Standard Tin Contract

It is learned that a revised contract for standard tin has been approved by the board of the London Metal Exchange. It will become operative for prompts maturing on and after January 1, 1959.

The main difference from the old contract is that only registered brands will be deliverable on the London market, thus bringing tin into line with the contracts for other metals. Hitherto, certain brands of tin not registered, such as Chinese, were deliverable on the market. Chinese tin will now have to be registered to qualify for delivery against the revised standard contract.

Forthcoming Meetings

September 15—Institute of Metal Finishing. London Branch. Northampton Polytechnic, St. John Street, London, E.C.1. "Recent Research on Macro and Micro-Throwing Power." Ernst Raub. 6.15 p.m.

September 16—Institute of Metal Finishing. South-West Branch. Grand Hotel, Bristol. "Architectural Colour Anodising." A. W. Brace. 7 p.m.

Metal Market News

THE week opened quietly, for New York was closed on September 1, Labor Day, and one way and another business was rather under the influence of the holiday season here. Wall Street sessions have been active and have shown an upward tendency, while the same thing can be said of conditions on the London Stock Exchange. Business in metals was no more than moderate, but the trend was steady apart from tin, which, from a high point of £751 three months, collapsed in a dramatic fashion, losing £20 in a couple of days. Reference is made to the tin situation below, but it does seem that on second thoughts the London market came to the conclusion that merely to limit imports of Russian tin into this market was no solution to the overriding problem of too much metal. Interest is now beginning to centre on the "meeting of the nations," which is to discuss the possibility of reaching agreement on plans for stabilizing prices and ruling out the extreme fluctuations which from time to time plague the non-ferrous metal world. It seems likely that zinc and lead will come in for a good deal of discussion, but there is a fairly general consensus of opinion that nothing concrete will emerge immediately as a result of these talks. It is understood that on an observer basis the Metal Exchange will be represented, and also the consumers. It is very doubtful whether the course of prices in Whittington Avenue will be in any way affected by these proceedings. For that matter, it is not known as yet what kind of information will be released.

The copper market opened very steady last week at £203 5s. 0d. for L.M.E. stocks were again reported 450 tons lower at 11,492 tons. On the following day came news of a strike at Kennecott's Utah mine, but this was short-lived and had no more than a passing influence on the market. Much more important was the news received late on Wednesday afternoon that Phelps Dodge had decided to change their basis of production from four days per week to five, with a consequent increase in output of about 42,000 tons per annum. However, the market, which had advanced, appeared to be largely unaffected by this report, and on Thursday the custom smelters, who had apparently been booking good business, advanced their quotation by 25 points to 26½ cents. At its best last week, copper touched £207, but the close was rather below this, for cash was quoted on Friday afternoon at £206 5s. 0d. and three months at £206 10s. 0d., these prices showing gains of £3 10s. 0d. and £3 15s. 0d. on the week. The turnover was about 6,450 tons, plus a very considerable

tonnage put through on the Kerb.

It does not appear that business in copper with consumers was very brisk here last week, but sellers in the standard market showed considerable reserve, and this put the market up, for there was certainly some covering to be done. Zinc and lead were quietly firm, with lead 22s. 6d. up for prompt and 7s. 6d. better forward, while zinc closed virtually unchanged. Following the Board of Trade import restriction announcement, tin staged a big rise on Monday of last week, as much as £752 being paid for cash on the Kerb and £751 for three months. Second thoughts, however, followed quickly, and by Wednesday all the gain had been lost, the close after a turnover of fully 1,650 tons, without Kerb dealing, being £730 10s. 0d. cash and £728 three months, these prices showing losses of £2 10s. 0d. and £5 10s. 0d. for the respective positions. Over last week-end came news from Northern Rhodesia that the European Mineworkers' Union would hold a strike ballot.

New York

Easiness in the custom smelter copper price and firmness in tin were the leading developments during the past week. The lower trend in London copper and lagging sales by at least the leading custom smelter prompted a half-cent lowering of the price to 26 cents. At the new price level, which was a half-cent below the producer price, custom smelters indicated active sales. Producers indicated that because of the half-cent differential, custom smelters could be expected to bite sharper into producer copper sales.

Metal observers noted that a half-cent roughly has been the traditional differential between the custom smelter copper price and the producer price for electrolytic. Copper producers generally noted that sales for September delivery have been good, although some slackening developed in the latter part of the week, influenced by the long holiday week-end. Copper fabricators said their business was "about as it has been for some time." Some said September "looks better" largely because of expectations that the automotive industry will have to start ordering copper and brass strip products in order to turn out 1959 models.

The producer copper price of 16½ cents/lb. appeared firmly based, said informed copper sources. One copper expert suggested that the London price would have to fall to around 24 cents/lb. before imported metal could compete in the U.S. at the current 26½ cent producer price.

Lead and zinc prices remained

steady, with business fair. One leading seller noted that they did active business in Prime Western zinc and lead, mostly for August delivery. The Presidential decision on tariff increases in lead and zinc is still being studied, and trade circles do not expect any action by the President until after the forthcoming London meeting, under United Nations auspices, on September 8-11, to consider the world price situation in lead, zinc and copper.

Some observers speculated the conference might lead to agreements which would restrict production of those countries now exporting lead and zinc to the United States, which could have great influence on tariff action by the U.S. Tin firmed late in the week on the report that Britain and Holland have agreed to curb imports of tin and tin alloys from the Soviet Union in a move to protect the economies of the world's main tin producer nations.

Initial trade reaction to this was that the move would temporarily aid the market, but that Russian tin would reach the market through other channels. Traders here awaited further details about the curbing of Russian tin imports by other countries.

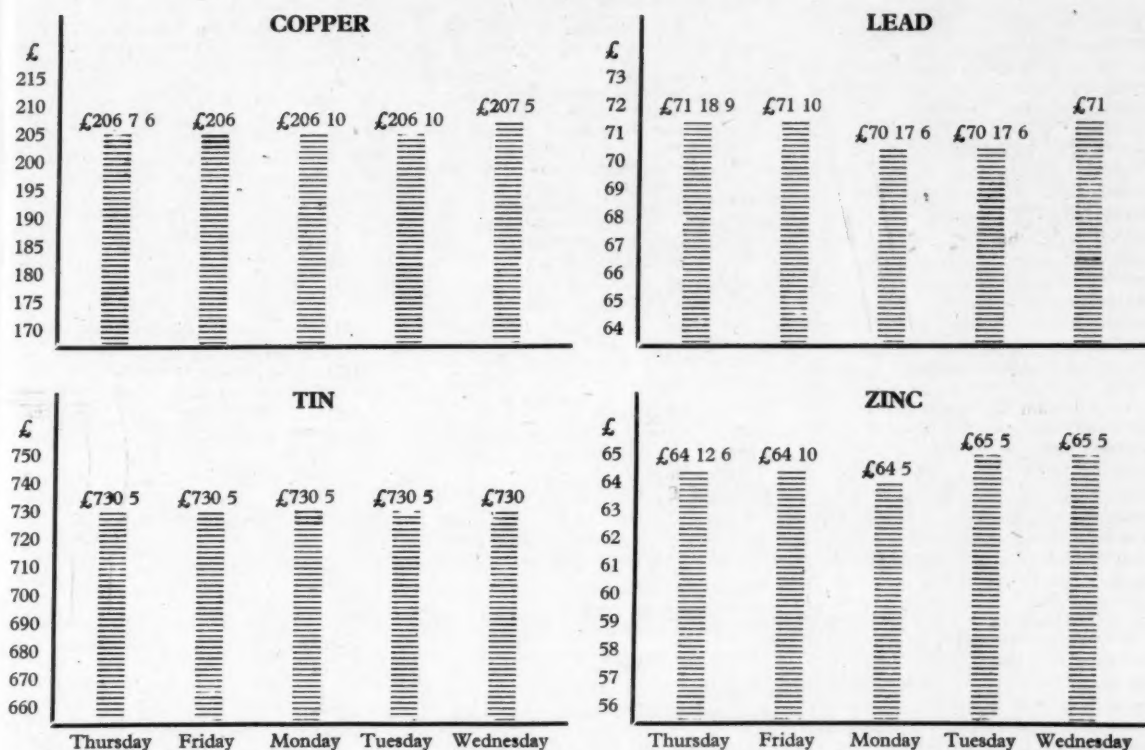
Birmingham

It is significant of the change which has taken place in the Midland industrial situation that, for the first time for a number of years, some of the big engineering firms now have no vacancies. Unemployment has also risen, and the latest figures of the Ministry of Labour are inflated by an unusually large number of school leavers who have yet to be absorbed into the industrial population. There has been little change in the general picture since work was resumed after the holidays. A moderate amount of business is being done in the metal rolling mills and foundries, and capacity exists for a much bigger output than is being made at present. Demands from the motor trade are well maintained.

In the iron and steel trade, a blast furnace has recently closed down in the Midland area through lack of trade, but there are still adequate supplies for both steel production and foundry work. The most active section of the foundry trade is concerned with heavy castings, and the strength of the engineering industries is maintained. No improvement has taken place in structural contracting, and unless new contracts come in to replace those being completed, the outlook for structural steel is gloomy. A substantial amount of steel is being used in the modernization schemes of the railways, but there is some curtailment of expenditure on steel for coal mining work.

METAL PRICE CHANGES

LONDON METAL EXCHANGE, Thursday 4 September 1958 to Wednesday 10 September 1958



OVERSEAS PRICES

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ⇌ £/ton	Canada c/lb ⇌ £/ton	France fr/kg ⇌ £/ton	Italy lire/kg ⇌ £/ton	Switzerland fr/kg ⇌ £/ton	United States c/lb ⇌ £/ton
Aluminium		22.50 185 17 6	210 182 15	375 217 10		26.80 214 10
Antimony 99.0			195 169 12 6	420 243 12 6		29.00 232 0
Cadmium			1,500 1,305 0			155.00 1,240 0
Copper						
Crude				415 240 15		
Wire bars 99.9	29.00 212 0	24.75 204 10	260 226 5		2.65 221 10	26.50 212 0
Electrolytic						
Lead		10.50 86 15	110 95 15	175 101 10	.88 73 10	10.75 86 0
Magnesium						
Nickel		70.00 578 5	1,205 1,048 7 6	1,300 754 0	7.50 627 2 6	74.00 592 0
Tin	102.25 747 10		893 777 0	1,420 823 12	8.60 719 2 6	94.75 758 0
Zinc						
Prime western		10.00 82 12 6				10.00 80 0
High grade 99.95		10.60 87 10 0				
High grade 99.99		11.00 90 5				
Thermic			107.12 93 2 6			
Electrolytic			115.12 100 2 6	159 92 5	.88 73 10	11.25 90 0

NON-FERROUS METAL PRICES

(All prices quoted are those available at 12 noon 10/9/58)

PRIMARY METALS

	£	s.	d.
Aluminium Ingots.... ton	180	0	0
Antimony 99.6% "	197	0	0
Antimony Metal 99% .. "	190	0	0
Antimony Oxide..... "	180	0	0
Antimony Sulphide Lump..... "	190	0	0
Antimony Sulphide Black Powder..... "	205	0	0
Arsenic..... "	400	0	0
Bismuth 99.95%..... lb.	16	0	0
Cadmium 99.9% "	10	0	0
Calcium..... "	2	0	0
Cerium 99%..... "	16	0	0
Chromium..... "	6	11	0
Cobalt..... "	16	0	0
Columbite..... per unit	—	—	—
Copper H.C. Electro... ton	207	5	0
Fire Refined 99.70% .. "	206	0	0
Fire Refined 99.50% .. "	205	0	0
Copper Sulphate..... "	70	0	0
Germanium..... grm.	—	—	—
Gold..... oz.	12	10	7½
Indium..... "	10	0	0
Iridium..... "	20	0	0
Lanthanum..... grm.	15	0	0
Lead English..... ton	71	0	0
Magnesium Ingots.... lb.	2	5½	0
Notched Bar..... "	2	10½	0
Powder Grade 4..... "	6	3	0
Alloy Ingot, A8 or AZ91 .. "	2	8	0
Manganese Metal.... ton	290	0	0
Mercury..... flask	79	0	0
Molybdenum..... lb.	1	10	0
Nickel..... ton	600	0	0
F. Shot..... lb.	5	5	0
F. Ingot..... "	5	6	0
Osmium..... oz.	nom.	—	—
Osmiridium..... "	nom.	—	—
Palladium..... "	5	15	0
Platinum..... "	23	5	0
Rhodium..... "	40	0	0
Ruthenium..... "	16	0	0
Selenium..... lb.	nom.	—	—
Silicon 98%..... ton	nom.	—	—
Silver Spot Bars..... oz.	6	4	0
Tellurium..... lb.	15	0	0
Tin..... ton	730	0	0
*Zinc			
Electrolytic..... ton	—	—	—
Min 99.99%..... "	—	—	—
Virgin Min 98%..... "	65	3	1½
Dust 95/97%..... "	104	0	0
Dust 98/99%..... "	110	0	0
Granulated 99+ % .. "	90	3	1½
Granulated 99.99+ % .. "	103	0	0

*Duty and Carriage to customers' works for buyers' account.

INGOT METALS

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	210	0	0
B.S. 1490 L.M.6 "	202	0	0
B.S. 1490 L.M.7 "	216	0	0
B.S. 1490 L.M.8 "	203	0	0
B.S. 1490 L.M.9 "	203	0	0
B.S. 1490 L.M.10.... "	221	0	0
B.S. 1490 L.M.11.... "	215	0	0
B.S. 1490 L.M.12.... "	223	0	0
B.S. 1490 L.M.13.... "	216	0	0
B.S. 1490 L.M.14.... "	224	0	0
B.S. 1490 L.M.15.... "	210	0	0
B.S. 1490 L.M.16.... "	206	0	0
B.S. 1490 L.M.18.... "	203	0	0
B.S. 1490 L.M.22.... "	210	0	0

Aluminium Alloy (Secondary)	£	s.	d.
B.S. 1490 L.M.1 ton	146	0	0
B.S. 1490 L.M.2 "	153	0	0
B.S. 1490 L.M.4 "	170	10	0
B.S. 1490 L.M.6 "	188	10	0
†Average selling prices for mid August			

*Aluminium Bronze	£	s.	d.
BSS 1400 AB.1..... ton	—	—	—
BSS 1400 AB.2..... "	230	0	0

*Brass	£	s.	d.
BSS 1400-B3 65/35 .. "	121	0	0
BSS 249..... "	—	—	—
BSS 1400-B6 85/15 .. "	—	—	—

*Gunmetal	£	s.	d.
R.C.H. 3/4% ton.... ton	—	—	—
(85/5/5/5)..... "	169	0	0
(86/7/5/2)..... "	177	0	0
(88/10/2/1)..... "	229	0	0
(88/10/2/½)..... "	235	0	0

Manganese Bronze	£	s.	d.
BSS 1400 HTB1.... "	169	0	0
BSS 1400 HTB2.... "	—	—	—
BSS 1400 HTB3.... "	—	—	—

Nickel Silver	£	s.	d.
Casting Quality 12% .. "	nom.	—	—
" " 16% .. "	nom.	—	—
" " 18% .. "	nom.	—	—

*Phosphor Bronze	£	s.	d.
2B8 guaranteed A.I.D. released..... "	252	0	0

Phosphor Copper	£	s.	d.
10%..... "	225	10	0
15%..... "	232	0	0

*Average prices for the last week-end.

Phosphor Tin	£	s.	d.
5%..... ton	—	—	—

Silicon Bronze	£	s.	d.
BSS 1400-SB1..... "	—	—	—

Solder, soft, BSS 219	£	s.	d.
Grade C Tinmans.... "	344	3	0
Grade D Plumbers... "	278	3	0
Grade M..... "	377	3	0

Solder, Brazing, BSS 1845	£	s.	d.
Type 8 (Granulated) lb.	—	—	—
Type 9..... "	—	—	—

Zinc Alloys	£	s.	d.
Mazak III..... ton	96	5	0
Mazak V..... "	100	5	0
Kayem..... "	106	5	0
Kayem II..... "	112	5	0
Sodium-Zinc..... lb.	2	5	0

SEMI-FABRICATED PRODUCTS

Prices of all semi-fabricated products vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium	£	s.	d.
Sheet 10 S.W.G. lb.	2	8	0
Sheet 18 S.W.G. .. "	2	10	0
Sheet 24 S.W.G. .. "	3	1	0
Strip 10 S.W.G. .. "	2	8	0
Strip 18 S.W.G. .. "	2	9	0
Strip 24 S.W.G. .. "	2	10½	0
Circles 22 S.W.G. .. "	3	2	0
Circles 18 S.W.G. .. "	3	1	0
Circles 12 S.W.G. .. "	3	0	0
Plate as rolled..... "	2	7½	0
Sections..... "	3	1½	0
Wire 10 S.W.G. "	2	11	0
Tubes 1 in. o.d. 16 S.W.G. "	4	0	0

Aluminium Alloys

Aluminium Alloys	£	s.	d.
BS1470. HS10W. lb.			
Sheet 10 S.W.G. .. "	3	0½	0
Sheet 18 S.W.G. .. "	3	3	0
Sheet 24 S.W.G. .. "	3	10½	0
Strip 10 S.W.G. .. "	3	0½	0
Strip 18 S.W.G. .. "	3	2	0
Strip 24 S.W.G. .. "	3	10	0
BS1477 HP30M. Plate as rolled..... "	2	10½	0
BS1470. HC15WP. Sheet 10 S.W.G. lb.	3	6½	0
Sheet 18 S.W.G. .. "	4	0½	0
Sheet 24 S.W.G. .. "	4	10½	0
Strip 10 S.W.G. .. "	3	9½	0
Strip 18 S.W.G. .. "	4	0½	0
Strip 24 S.W.G. .. "	4	8	0
BS1477. HPC15WP. Plate heat treated .. "	3	5½	0
BS1475. HG10W. Wire 10 S.W.G. .. "	3	9½	0
BS1471. HT10WP. Tubes 1 in. o.d. 16 S.W.G. "	4	11	0
BS1476. HE10WP. Sections..... "	3	1	0

Beryllium Copper	£	s.	d.
Strip..... "	1	4	11
Rod..... "	1	1	6
Wire..... "	1	4	9

Brass Tubes..... "	£	s.	d.
Brazed Tubes..... "	—	—	—
Drawn Strip Sections..... "	—	—	—
Sheet..... ton	—	—	—
Strip..... "	228	0	0
Extruded Bar..... lb.	1	9½	0
Extruded Bar (Pure Metal Basis)..... "	—	—	—
Condenser Plate (Yellow Metal)..... ton	165	0	0
Condenser Plate (Naval Brass)..... "	176	0	0
Wire..... lb.	2	5	0

Copper Tubes..... lb.	£	s.	d.
Sheet..... ton	233	15	0
Strip..... "	233	15	0
Plain Plates..... "	—	—	—
Locomotive Rods..... "	—	—	—
H.C. Wire..... "	256	15	0

Cupro Nickel	£	s.	d.
Tubes 70/30..... lb.	3	4½	0

Lead Pipes (London) .. ton	£	s.	d.
Sheets (London) .. "	110	0	0
Tellurium Lead..... "	107	15	0
	£6 extra		

Nickel Silver	£	s.	d.
Sheet and Strip 7% .. "	3	5½	0
Wire 10%..... "	3	11½	0

Phosphor Bronze	£	s.	d.
Wire..... "	3	9½	0

Titanium (1,000 lb. lots)	£	s.	d.
Billet over 4" dia.-18" dia. lb.	63/-	64/-	
Rod 4" dia.-250" dia. .. "	75/-	112/-	
Wire under 250" diam.-036" diam. "	146/-	222/-	
Sheet 8" x 2" x 250"-010" thick..... "	88/-	157/-	
Strip 048"-003" thick.. "	100/-	350/-	
Tube (representative gauge)..... "	300/-		
Extrusions..... "	120/-		

Zinc Sheets, English destinations..... ton	£	s.	d.
Strip..... "	nom.		

Financial News

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for June, 1958, have been issued by the Ministry of Supply as follow (in long tons):—

Virgin Aluminium

Production	1,858
Imports	20,406
Despatches to consumers	16,835

Secondary Aluminium

Production	9,292
Virgin content of above	913
Despatches (including virgin content)	9,126

Secondary in Consumption (per cent)

Wrought products	5.3
Cast products	82.4
Destructive uses (aluminium content irrecoverable)	74.1
Total consumption	28.1

Scrap

Arisings	12,321
Estimated quantity of metal recoverable	8,738
Consumption by:	
(a) Secondary smelters	10,788
(b) Other users	1,266

Despatches of wrought and cast products

Sheet, strip and circles	11,451
Extrusions (excluding forging bar, wire-drawing rod and tube shell):	
(a) Bars and sections	2,452
(b) Tubes (i) extruded	217
(ii) cold drawn	421
(c) (i) Wire	2,113
(ii) Hot rolled rod (not included in (c) (i))	143
Forgings	274
Castings: (a) Sand	1,574
(b) Gravity die	3,840
(c) Pressure die	1,460

Foil

Paste

Magnesium Fabrication

Sheet and strip	6
Extrusions	46
Castings	140
Forgings	5

LIGHT METALS STATISTICS IN JAPAN (May, 1958)

Classification	Pro- duction	Ship- ment	Stock	Export
Alumina	17,327	17,896	11,520	2,737
Aluminium				
Primary	7,477	7,930	2,808	696
Secondary	1,899	1,814	317	0
Rolled Products	5,697	5,746	1,697	594
Electric Wire	938	1,020	1,035	219
Sheet Products	1,338	1,278	923	77
Castings	1,662	—	—	—
Die-Castings	921	—	—	—
Forgings	14	—	—	—
Powder	—	—	—	—
Primary Aluminium (June)	7,428	7,841	1,942	521
Sponge				
Titanium	130	132	778	130
Magnesium				
Secondary	73	72	1	0
	215	188	243	0

Trade Publications

Claw-Type Cable Cleating System.—

British Insulated Callender's Cables Ltd., 21 Bloomsbury Street, London, W.C.1.
This eight-page leaflet contains details of the claw-type cable cleating system which has been developed by the company to provide a universal assembly which can easily be built up, modified or adapted on site to suit any particular arrangement or rearrangement of cables.

Diecastings in Zinc Alloy.—

George Goodman Ltd., Robin Hood Lane, Birmingham, 28.
This leaflet describes fully this company's new technique in the zinc alloy die-casting field. It is noticed that they employ a single-cavity high-speed technique instead of the conventional multi-impression method. A number of illustrations are included in the leaflet.

Compensating Cables.—

Mersey Cable Works Ltd., Linacre Lane, Bootle, Liverpool.
Their range of compensating cables for pyrometry purposes is outlined in a new

leaflet issued by this company. Five categories of compensating cable are described in terms of physical construction, overall diameter in inches, and approximate weight per 1,000 yd.

Metal Finishing.—

Roto-Finish Limited, Mark Road, Hemel Hempstead, Herts.
In the latest issue of the Roto-Finish Roundabout, the house journal of the above company, a leading article deals with the Free Trade Area in Europe, followed by an illustrated article on Roto-Finish special purpose machines, this being the second article in the series.

Liquefied Petroleum Gas Plant.—

W. C. Holmes and Co., Turnbridge, Huddersfield.
Commercial usage on a large scale of propane and butane has led to the manufacture of specialized equipment for their storage, and an eight-page brochure describing this type of installation has been issued.

Hot Brass Pressings.—

Manley and Regulus Ltd., Showell Rd., Wolverhampton.
In a strikingly presented catalogue, this company illustrates and describes its range of hot pressings, including engineering components and plumbers' fittings for the gas, water, electrical, motor, agricultural, and other industries. Fittings of this type are made in brass, manganese bronze, naval brass, copper, and several other non-ferrous alloys.

Scrap Metal Prices

Merchants' average buying prices delivered, per ton, 9/9/58.

Aluminium	£	Gunmetal	£
New Cuttings	134	Gear Wheels	164
Old Rolled	110	Admiralty	164
Segregated Turnings	90	Commercial	140
		Turnings	135
Brass		Lead	
Cuttings	127	Scrap	62
Rod Ends	122		
Heavy Yellow	106	Nickel	
Light	101	Cuttings	—
Rolled	119	Anodes	450
Collected Scrap	102		
Turnings	116	Phosphor Bronze	
Copper		Scrap	140
Wire	175	Turnings	135
Firebox, cut up	171		
Heavy	166	Zinc	
Light	161	Remelted	55
Cuttings	175	Cuttings	42
Turnings	157	Old Zinc	30
Braziery	137		

The latest available scrap prices quoted on foreign markets are as follow. (The figures in brackets give the English equivalents in £1 per ton):—

West Germany (D-marks per 100 kilos):

Used copper wire	(£178.7.6) 205
Heavy copper	(£174.0.0) 200
Light copper	(£143.10.0) 165
Heavy brass	(£108.15.0) 125
Light brass	(£78.7.6) 90
Soft lead scrap	(£61.0.0) 70
Zinc scrap	(£34.17.6) 40
Used aluminium unsorted	(£87.0.0) 100

France (francs per kilo):

Copper	(£208.17.6) 240
Heavy copper	(£208.17.6) 240
Light brass	(£143.10.0) 165
Zinc castings	(£65.5.0) 75
Lead	(£82.12.6) 95
Tin	(£565.10.0) 650
Aluminium	(£117.10.0) 135

Italy (lire per kilo):

Aluminium soft sheet	
clippings (new) ..	(£191.10.0) 330
Aluminium copper alloy	(£119.0.0) 205
Lead, soft, first quality	(£84.12.6) 146
Lead, battery plates ..	(£49.17.6) 86
Copper, first grade ..	(£194.7.6) 335
Copper, second grade	(£179.17.6) 310
Bronze, first quality	
machinery	(£188.10.0) 325
Bronze, commercial	
gunmetal	(£159.10.0) 275
Brass, heavy	(£130.10.0) 225
Brass, light	(£119.0.0) 205
Brass, bar turnings ..	(£127.12.6) 220
New zinc sheet clip-	
pings	(£55.2.6) 95
Old zinc	(£40.12.6) 70

THE STOCK EXCHANGE

Industrial Market Continues To Attract Steady Support

ISSUED CAPITAL	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 9 SEPTEMBER +RISE -FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1958 HIGH LOW	1957 HIGH LOW
£	£			Per cent	Per cent			
4,435,792	1	Amalgamated Metal Corporation ...	21/6 +6d.	9	10	8 7 6	21/6 17/6	28/3 18/-
400,000	2/-	Anti-Attrition Metal ...	1/6	4	8½	5 6 9	1/6 1/3	2/6 1/6
33,639,483	Sck. (£1)	Associated Electrical Industries ...	53/3xd	15	15	5 12 9	53/7½ 46/6	72/3 47/9
1,590,000	1	Birfield Industries ...	55/6 +1/3	15	15	5 8 0	57/- 46/3	70/- 48/9
3,196,667	1	Birmid Industries ...	74/9 +3d.	17½	17½	4 13 9	76/3 55/3	80/6 55/9
5,630,344	Sck. (£1)	Birmingham Small Arms ...	31/7½ +7½d.	10	8	6 6 6	32/3 23/9	33/- 21/9
203,150	Sck. (£1)	Ditto Cum. A. Pref. 5% ...	15/6	5	5	6 9 0	15/7½ 14/7½	16/- 15/-
350,580	Sck. (£1)	Ditto Cum. B. Pref. 6% ...	17/3	6	6	6 19 3	17/3 16/6	19/- 16/6
500,000	1	Bolton (Thos.) & Sons ...	25/-	12½	12½	10 0 0	28/9 24/-	30/3 28/9
300,000	1	Ditto Pref. 5% ...	15/6	5	5	6 9 0	16/- 15/-	16/9 14/3
160,000	1	Booth (James) & Co. Cum. Pref. 7% ...	20/-	7	7	7 0 0	19/4½ 19/-	22/3 18/9
9,000,000	Sck. (£1)	British Aluminium Co. ...	54/6 +1/6	12	12	4 8 0	54/6 36/6	72/- 38/3
1,500,000	Sck. (£1)	Ditto Pref. 6% ...	18/10½	6	6	6 7 3	19/3 18/4½	21/6 18/-
15,000,000	Sck. (£1)	British Insulated Callender's Cables ...	45/-	12½	12½	5 11 0	46/- 38/9	55/- 40/-
17,047,166	Sck. (£1)	British Oxygen Co. Ltd., Ord. ...	39/6	10	10	5 1 3	40/- 29/-	39/- 29/6
600,000	Sck. (5/-)	Canning (W.) & Co. ...	22/3	25 + *2½C	25	5 12 6	22/3 19/7½	24/6 19/3
60,484	1/-	Carr (Chas.) ...	1/10½	25	25	9 6 9X	2/3 1/4½	3/6 2/1½
150,000	2/-	Case (Alfred) & Co. Ltd. ...	4/1½	25	25	12 2 6	4/9 4/-	4/6 4/-
555,000	1	Clifford (Chas.) Ltd. ...	20/-	10	10	10 0 0	20/- 16/-	20/6 15/9
45,000	1	Ditto Cum. Pref. 6% ...	15/9	6	6	7 12 6	15/10½ 15/7½	17/6 16/-
250,000	2/-	Coley Metals ...	3/3	20	25	12 6 3	4/6 2/6	5/7½ 3/9
8,730,596	1	Cons. Zinc Corp.† ...	53/6 +2/-	18½	22½	7 0 3	53/6 41/-	92/6 49/-
1,136,233	1	Davy & United ...	71/3 +1/3	20	15	5 12 3	72/6 45/9	60/6 42/6
2,750,000	5/-	Delta Metal ...	21/-	30	*17½	7 2 9	22/4½ 17/7½	28/6 19/-
4,170,000	Sck. (£1)	Enfield Rolling Mills Ltd. ...	34/9 +9d.	12½	15B	7 4 0	35/- 22/9	38/6 25/-
750,000	1	Evered & Co. ...	27/3	15Z	15	7 6 3	28/3 26/-	52/9 42/-
18,000,000	Sck. (£1)	General Electric Co. ...	36/6 +9d.	10	12½	5 9 6	38/7½ 29/6	59/- 38/-
1,500,000	Sck. (10/-)	General Refractories Ltd. ...	36/9 +1/-	20	17½	5 8 9	36/9 27/3	37/- 26/9
401,240	1	Gibbons (Dudley) Ltd. ...	61/6	15	15	4 17 6	66/3 61/-	71/- 53/-
750,000	5/-	Glacier Metal Co. Ltd. ...	6/- +3d.	11½	11½	9 11 9	6/6 5/6	8/1½ 5/10½
1,750,000	5/-	Glynwed Tubes ...	17/6 +3d.	20	20	5 14 3	17/6 12/10½	18/- 12/6
5,421,049	10/-	Goodlass Wall & Lead Industries ...	24/9 —3d.	13½	18Z	5 5 0	25/9 19/3	37/3 28/9
342,195	1	Greenwood & Batley ...	48/9	20	17½	8 4 0	49/3 45/-	50/- 46/-
396,000	5/-	Harrison (B'ham) Ord. ...	13/9 —3d.	*15	*15	5 9 0	14/- 11/6	16/9 12/4½
150,000	1	Ditto Cum. Pref. 7% ...	19/-	7	7	7 7 3	19/- 18/9	22/3 18/7½
1,075,167	5/-	Heenan Group ...	8/7½ +4½d.	10	20½	5 16 0	8/7½ 6/9	10/4½ 6/9
216,531,615	Sck. (£1)	Imperial Chemical Industries ...	34/- +9d.	12Z	10	4 14 0	34/- 27/7½	46/6 36/3
33,708,769	Sck. (£1)	Ditto Cum. Pref. 5% ...	17/-	5	5	5 17 9	17/1½ 16/-	18/6 15/6
14,584,025	**	International Nickel ...	150½ +1½	\$3.75	\$3.75	4 9 6	154½ 132½	222 130
430,000	5/-	Jenks (E. P.), Ltd. ...	7/9	27½φ	27½	8 17 6	8/3 6/9	18/10½ 15/1½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5% ...	16/3	5	5	6 3 0	16/9, 15/-	17/- 14/6
3,987,435	1	Ditto Ord. ...	41/3 +9d.	10	10	4 17 0	45/3 36/6	58/9 40/-
600,000	10/-	Keith, Blackman ...	21/3	17½	15	8 5 0	21/3 15/-	21/9 15/-
160,000	4/-	London Aluminium ...	4/4½	10	10	9 2 9	4/4½ 3/-	6/9 3/6
2,400,000	1	London Elec. Wire & Smith's Ord. ...	47/6 +6d.	12½	12½	5 5 3	47/6 39/9	54/6 41/-
400,000	1	Ditto Pref. ...	23/3	7½	7½	6 9 0	23/3 22/3	25/3 21/9
765,012	1	McKechnie Brothers Ord. ...	36/9	15	15	8 3 3	36/9 32/-	48/9 37/6
1,530,024	1	Ditto A Ord. ...	35/-	15	15	8 11 6	35/- 30/-	47/6 36/-
1,108,268	5/-	Manganese Bronze & Brass ...	12/3 +9d.	20	27½	8 3 3	12/3 8/9	21/10½ 7/6
50,628	6/-	Ditto (7½% N.C. Pref.) ...	5/9	7½	7½	7 16 6	6/3 5/9	6/6 5/-
13,098,855	Sck. (£1)	Metal Box ...	56/- +2/6	11	11	3 18 6	56/- 41/9	59/- 40/3
415,760	Sck. (2/-)	Metal Traders ...	8/1½	50	50	12 6 3	8/1½ 6/3	8/- 6/3
160,000	1	Mint (The) Birmingham ...	20/-	10	10	10 0 0	22/9 19/-	25/- 21/6
80,000	5	Ditto Pref. 6% ...	79/6	6	6	7 11 0	83/6 79/6	90/6 83/6
3,705,670	Sck. (£1)	Morgan Crucible A ...	40/6	10	10	4 18 9	40/6 34/-	54/- 35/-
1,000,000	Sck. (£1)	Ditto 5½% Cum. 1st Pref. ...	17/-	5½	5½	6 7 6	17/3 17/-	19/3 16/-
2,200,000	Sck. (£1)	Murex ...	50/9 —3d.	17½	20	6 18 0	58/9 47/9	79/9 57/-
468,000	5/-	Ratcliffs (Great Bridge) ...	9/4½ +7½d.	10	10	5 6 9	9/4½ 6/10½	8/- 6/10½
234,960	10/-	Sanderson Bros. & Newbould ...	24/9	20	27½D	8 1 6	27/- 24/6	41/- 24/9
1,365,000	Sck. (5/-)	Serck ...	15/1½ +1½d.	17½Z	15	3 12 9	15/3 11/-	18/10½ 11/6
600,400	Sck. (£1)	Stone (J.) & Co. (Holdings) ...	63/9	18	16	5 13 0	63/9 43/9	57/6 43/9
600,000	1	Ditto Cum. Pref. 6½% ...	23/6	6½	6½	5 10 9	24/3 19/6	21/9 18/9
14,494,862	Sck. (£1)	Tube Investments Ord. ...	59/6 +1/3	15	15	5 9 9	59/6 48/4½	70/9 50/6
41,000,000	Sck. (£1)	Vickers ...	33/9 +3d.	10	10	5 19 0	33/9 28/9	46/- 29/-
750,000	Sck. (£1)	Ditto Pref. 5% ...	14/3	5	5	7 0 3	15/6 14/3	18/- 14/-
6,863,807	Sck. (£1)	Ditto Pref. 5% tax free ...	21/9	*5	*5	7 1 3A	23/- 21/3	24/9 20/7½
2,200,000	1	Ward (Thos. W.), Ord. ...	80/-	20	15	5 0 0	80/9 70/9	83/- 64/-
2,666,034	Sck. (£1)	Westinghouse Brake ...	39/- +6d.	10	18P	5 2 6	40/- 32/6	85/- 29/1½
225,000	2/-	Wolverhampton Die-Casting ...	8/9 +6d.	25	40	5 14 3	8/9 7/1½	10/1½ 7/-
591,000	5/-	Wolverhampton Metal ...	19/6 —3d.	27½	27½	7 1 0	19/9 14/9	22/3 14/9
78,465	2/6	Wright, Bindley & Gell ...	4/-	20	17½E	12 10 0	4/0½ 3/3	3/9 2/7½
124,140	1	Ditto Cum. Pref. 6% ...	12/1½ —4½d.	6	6	9 18 0	12/6 11/3	12/6 11/3
150,000	1/-	Zinc Alloy Rust Proof ...	2/10½ —1½d.	27	40D	9 7 9	3/1½ 2/7½	5/- 2/9

*Dividend paid free of Income Tax. †Incorporating Zinc Corp. & Imperial Smelting **Shares of no Par Value. ‡ and 100% Capitalized Issue. ●The figures given relate to the issue quoted in the third column. A Calculated on £7 14 6 gross. Y Calculated on 11½% dividend. || Adjusted to allow for capitalization issue. E for 15 months. P and 100% capitalized issue, also "rights" issue of 2 new shares at 35/- per share for £3 stock held. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. φ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits.

